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BIANNUAL REPORT-- January - June 1983

BIANNUAL REPORT

of the

MONTANA COOPERATIVE WILDLIFE RESEARCH UNIT

University of Montana

Missoula, Montana

to

UNIVERSITY OF MONTANA

MONTANA FISH, WILDLIFE AND PARKS DEPARTMENT

WILDLIFE MANAGEMENT INSTITUTE

U.S. FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR

Vol. 33, No. 2
January - June 1983

Respectfully Submitted,

Bart O'Gara

Bart W. O'Gara, Leader

Joe Ball, Ass't Leader

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MONTANA COOPERATIVE WILDLIFE RESEARCH UNIT PERSONNEL

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Randy Matchett
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Pat Mullen
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COOPERATING AGENCIES

University of Montana
Montana Fish, Wildlife, and Parks Department
Wildlife Management Institute
U.S. Fish and Wildlife Service

Alaska Department of Fish and Game
Alberta Fish and Wildlife Division
American Petroleum Institute
Arctic Institute of North America
Bear Country Products
Border Grizzly Project
Bowdoin National Wildlife Refuge
British Columbia Fish & Wildlife Branch
Bureau of Indian Affairs
Bureau of Land Management
Bureau of Reclamation, Lower Missouri Region
Charles M. Russell National Wildlife Refuge
Colorado Division of Wildlife
Confederated Salish and Kootenai Tribes
Denver Wildlife Research Center
Double Four Corporation
Echo Bay Mines Limited
Idaho Department of Fish and Game
J.E. Davis
Missoula County Rodent Control Board
Montana Department of Agriculture
Montana Forest and Conservation Experiment Station
Montana Power Company
National Audubon Society
National Bison Range
National Hispanic Scholarship Fund
National Rifle Association
National Wildlife Federation
Naval Arctic Research Laboratory
New Jersey Raptor Association
Parks Canada
Rocky Mountain Forest and Range Experiment Station
Sheldon-Hart National Wildlife Refuge
Sigma Xi
Snake River Birds of Prey Research Project
Theodore Roosevelt Memorial Fund of the American Museum
U of M National Hispanic Scholarship Fund
University of Wyoming
U. S. Forest Service (Custer, Kootenai, Flathead, Targhee and Payette National Forests)
U. S. Department of Energy (INEL Site)
U. S. National Park Service (Glacier, Yellowstone Parks)
Utah Division of Wildlife Resources
Wildlife-Wildlands Institute

RESEARCH PROJECTS

Physiologic and Ecologic Studies of the Pronghorn (Antilocapra americana)

Project Leader: B. W. O'Gara

Cooperators: National Bison Range, U.S. Fish and Wildlife Service; Yellowstone National Park, U.S. National Park Service; and the Montana Fish, Wildlife and Parks Department

Objectives:

To study:

1. the reproductive physiology of male and female pronghorn;
2. the physiology and function of scent glands;
3. food habits related to changes in range conditions;
4. horn growth and casting; and
5. the relationships of pronghorns to other artiodactyls.

Results:

Work was continued on the pronghorn book.

Population Studies of Canada Geese in the Flathead Valley

Project Leaders: J. J. Craighead and I. J. Ball

Cooperators: USFWS, Montana Dept. Fish, Wildlife and Parks, BIA/Confederated Salish & Kootenai Tribes

Objectives:

1. To gather current data on populations, nesting areas, and nest success of Flathead geese.
2. To compare the current situation with conditions documented during 1953-60.
3. To relate changes in reproductive output of the geese to changes in habitat or management strategies since the 1950's.
4. To prepare a monograph using both historical and current data.

Results:

Target date for a draft of the monograph is December 1983.

ABSTRACT

Young, Leonard Stephen, M.S., Winter 1983 Wildlife Biology

Movements of bald eagles associated with autumn
concentrations in Glacier
National Park (102 pp.)

Director: B. Riley McClelland

Movements of bald eagles (Haliaeetus leucocephalus) associated with autumn concentrations in Glacier National Park were studied during 1979-81. The objectives of the study were to describe movements and habitats used by this group of eagles and to identify a conceptual framework for management of bald eagles and their habitats at the regional level.

Twenty eagles were captured and equipped with radio transmitters at Glacier National Park during autumns 1979 and 1980. Eagles moved south from Glacier through the Flathead and Swan valleys of northwestern Montana. Three eagles remained in these valleys during winter, but most continued south through eastern Idaho. Wintering areas were documented at American Falls Reservoir on the Snake River, Idaho; the Snake River headwaters region of Wyoming, Idaho, and Utah; the Weber River Valley, Utah; the Rush Valley, Utah; the Snake River near Ontario, Oregon; the Carson Valley, Nevada; and the Klamath Basin, Oregon-California. All wintering areas were within the Intermountain Region. Sightings of additional eagles equipped with colored patagial wing markers at Glacier during autumns 1977-80 fell predominantly (93%) within the Intermountain Region and were made most frequently in areas used by transmitter-equipped eagles.

In Spring, adult eagles followed converging routes from wintering areas to northwestern Montana and continued north along the foothills of the Rocky Mountains through southern Alberta. Near Lesser Slave Lake, Alberta, 2 routes diverged. Some eagles moved north-northeast toward Lake Claire in Wood Buffalo National Park and the east arm of Great Slave Lake, Northwest Territories. Others moved north-northwest toward the west end of Great Slave Lake and Great Bear Lake, N.W.T. Summer ranges were documented at Lake Claire; the Taltson River, N.W.T.; Great Slave Lake; and Great Bear Lake.

The most coherent unit for management of bald eagles and their habitats at the regional level appears to be a broad north-south zone, i.e. a flyway. A flyway system that transcends international boundaries seems to offer the greatest potential for long-term conservation of the species.

ABSTRACT

Becker, Dale M. Wildlife Biology

Reproductive Ecology and Habitat Utilization of Richardson's Merlins in Southeastern Montana

Director: I. J. Ball

Reproductive ecology, food habits, habitat utilization, and the effects of rganochlorine pesticides were studied in a population of Richardson's Merlins (*Falco columbarius richardsonii*) in southeastern Montana. Breeding activity spanned five months from the arrival of adults until the latest dispersal of young from the nesting area. Clutch size, brood size, and fledging success at active nests were similar (P 0.05) among four years. Mortality was highest before hatching occurred. Birds comprised 90% of individual prey items, and 61% of the bird prey species were typically associated with grasslands or predominantly open habitats. Horned Larks (*Eremophila alpestris*), Vesper Sparrows (*Pooecetes gramineus*), and Lark Buntings (*Calamospiza melanocorys*) collectively accounted for 57% of all identified prey. Home ranges of three breeding male Merlins encompassed 13, 23, and 28 km. Home ranges encompassed five physiognomic habitat types. Percentages of observations by habitat indicated greatest use of sagebrush and grassland habitats. Sagebrush, prairie riparian, and ponderosa pine habitat types were utilized signficantly more (P 0.05) than expected, while grassland and agriculture habitats were utilized less (P 0.05) than expected. Average eggshell weights and eggshell thickness indices for eggs collected on the study area were significantly (P 0.01) lower than values for pre-pesticide (pre-1946) eggshells. Comparisons of Montana eggshells with pre-1946 eggshells indicated 13% and 20% reductions in eggshell weight and eggshell thickness indices, respectively. Six organochlorine compounds were detected in eggs that were collected on the study area. The overall management goals should be the maintenance of a viable population of Merlins and the habitat features essential for the continued existence of the population. Management recommendations involve population and pesticide monitoring, management of manipulation of habitat, management of human activities, and additional studies. Human activities should be managed by restricting alteration of ponderosa pine sideslope habitat, restricting activities from 10 March through 20 July, rescheduling activities, establishing a 400 m zone of no disturbance surrounding active nests, limiting loss of prairie habitat and sagebrush removal, and limiting use of organochlorine pesticides.

ABSTRACT

Flynn, Rodney W., M.S., Summer 1983 Wildlife Biology

Distribution, Status, and Feeding Ecology of the Sumatran Rhinoceros in Peninsular Malaysia

Director: Bart W. O'Gara

The distribution, status, and feeding ecology of the Sumatran rhinoceros in Peninsular Malaysia was investigated from 1975 to 1981. Information on distribution and status country-wide was collected from field surveys, interviews with people living near rhino areas, and the literature. I confirmed that rhinos presently occur in 10 isolated areas scattered throughout the Malay Peninsula. The number of rhinos was estimated at 50 to 80 with the Endau-Rompin (20-25), Taman Negara (8-12), and Susngai Dusun (4-6) areas containing the largest contiguous populations. The Sumatran rhino is threatened with extinction in Peninsular Malaysia. Excessive killing of rhinos has greatly reduced numbers; habitat destruction from logging and land clearance for agricultural development have reduced the amount of available habitat and isolated small populations. The Endau-Rompin region was found to be the most suitable site to maintain a viable population of rhinos in Malaysia because it contains the largest number of animals, evidence of reproduction has been observed, a law enforcement program has been started, and a portion of the area (870 km) has been proposed for national park status. Feeding ecology of the Sumatran rhino was studied in the Endau-Rompin region, southern Peninsular Malaysia, to provide information on foods eaten and habitats selected. Feeding sites were located by following recent rhino tracks. Within primary hill forest, Sumatran rhinos selected feeding sites in stream bottom (59%) and lower slope (34%) physiographic types. Small forest gaps (35%) were used more than their availability (15%), but most of the feeding cases were in closed-canopy forest (63%). Sumatran rhinos were mostly browsers, feeding primarily on the mature leaves of woody understory plants. Large, fleshy fruits were eaten occasionally. The diet was diverse with 49 plant families, 102 genera, and from 156 to 181 species represented in 342 feeding cases. *Prunus* sp. (15.1%), *Ficus* sp. (6.4%), *Pavetta* sp. (6.1%), *Medusanthera* sp. (3.8%), and *Eugenia* sp. (3.0) contributed the greatest amounts to diet proportions. Chemical analyses of plant materials, collected from certain food plants and randomly selected non-food plants, indicated that Sumatran rhinos selected plants and plant parts high in minerals and crude protein but low in fiber. Phenolics and tannins were tolerated in the diet, but principal food plants contained less tannin.

Pronghorn Antelope Behavior in Northwestern Nevada - Southeastern Oregon

Project Leader:	B. W. O'Gara
Student Investigator:	J. O. Meeker
Cooperators:	Sheldon-Hart National Wildlife Wildlife Reguge, Double Four Corporation, NRA

Objectives:

1. To determine seasonal movements of pronghorns (_Antilocapra americana_) that summer on Hart Mountain and Sheldon Antelope Refuges.
2. To determine breeding strategies used by pronghorn with home ranges in two habitat types (Low Sage-Bunchgrass and Playa).
3. To analyze any differences noted in objective 2 above in an ecological and behavioral framework.
4. To determine trace element content of vital organs and hair of pronghorn taken at Sheldon and Hart Mountain Wildlife Refuges.
5. To establish trace element baseline data for pronghorns at Sheldon and Hart Mountain Wildlife Refuges.
6. To compare trace element data from Sheldon and Hart Mountain with hair taken from Idaho and Montana pronghorns.

Results:

The student investigator successfully completed comprehensive examinations and was accepted for candidacy for a Doctor of Philosophy degree on April 25, 1983.

Analysis of collected data continued during the reporting period. Tissue analysis will be accomplished at Washington State University.

Winter Ecology of Mule Deer in the Rattlesnake Gulch Area

Project Leader:	I. J. Ball
Student Investigator:	R. Yeager
Cooperators:	Confederated Salish and Kootenai Tribes, Bureau of Indian Affairs, National Rifle Association

Objectives:

1. Document the relative importance of various habitat types to the mule deer that winter in the Rattlesnake Gulch Area.
2. Describe movement patterns of the deer and distribution on the winter range.
3. Estimate population size and age/sex composition.

Results:

The thesis is in the final stages of completion. An abstract will appear in the next biannual report.

Effects of Subdivisions and Grazing on Grant Creek Wild Ungulates

Project Leader:	B. W. O'Gara
Student Investigator:	D. Weybright
Cooperators:	Montana Department of Fish, Wildlife and Parks, National Wildlife Federation

Objectives:

1. To determine ungulate numbers, concentration areas, and migration routes on a traditional winter range prior to subdevelopment.
2. To determine forage production, utilization and range condition.
3. To document the process of subdevelopment and cattle grazing and make recommendations to minimize the negative impacts.

Results:

The student investigator has completed a rough draft of his Thesis.
The Abstract should appear in the next Biannual.

Recovery of a Ground Squirrel Population Following Applications of 1080 and Effects of the Poisoning Program on Coyotes

Project Leader:	B. W. O'Gara
Student Investigator:	T. Lingel-Pate
Cooperators:	Montana Department of Argiculture, Environmental

Management Division; Missoula County Rodent Control Board; Montana Department of Fish, Wildlife and Parks; US Fish and Wildlife Service, Denver Research Center

Objectives:

1. Measure the degree of ground squirrel reduction achieved by 1080 poisoning.
2. Quantify reproductive performance in treated and untreated ground squirrel populations.
3. Compare dispersal rates of young (juvenile and yearling) squirrels between treated and untreated populations.
4. Identify the source of immigrants that appear on treated areas.
5. Measure coyote population fluctuations on treated and control areas.
6. Investigate utilization of poisoned squirrel carcasses by ravens and coyotes, and associated mortality.

Results:

The student investigator is working on his thesis. The Abstract should appear in the next Biannual.

Moose-habitat Relationships in the Yaak Country, Northwestern Montana

Project Leaders: L. Metzgar and J. Ball
Student Investigator: R. Matchett
Cooperators: US Forest Service, Forest and Range Experiment Station, Kootenai National Forest; Montana Department of Fish, Wildlife and Parks; J.E. Davis

Objectives:

1. Document seasonal habitat selection by moose in representative portions of the Yaak Country.
2. Assess the impacts of logging on moose habitats, populations, and behavior.
3. Describe seasonal movement patterns of moose.
4. Develop guidelines for logging that will optimize benefits and minimize disturbance to moose.

Results:

The student investigator was in the field from 9 January until the present. Four more moose were fitted with radio collars during the winter. A total of 12 moose have been instrumented of which 8 are currently active. A total of 260 radio relocations and 66 sightings were recorded during the winter field season. A grand total of 483 radio locations and 281 sightings have been recorded. For each of these locations, pertinent habitat data have been recorded. For each of these locations, pertinent habitat data are being collected from the Forest Service district stand files and the Kootenai National Forest data base. Snow hardness and depth measurements and track counts were taken at weekly intervals on 6 routes throughout the study area during the winter.

The student will be in the field until September, but will make periodic trips to the University during the summer for library work and to use the computer for modelling efforts and data analysis. Radio-tracking will continue through the summer and habitat data collection will be completed. This fall, final data analysis will be done and coursework will be finished. Completion of the project is expected in late winter or spring of 1984.

Grizzly/Black Bear Interactions and Competition

Project Leader:	C. Jonkel
Student Investigator:	H. Carriles
Cooperators:	US Fish and Wildlife Service, Wildlife Management Institute, National Rifle Association, US National Park Service, Montana Department of Fish, Wildlife and Parks, US Forest Service, University of Montana, National Hispanic Scholarship Fund

Objectives:

1. Determine black bear food habits by analysis of scats from known collared female bears and their offspring.
2. Determine habitat use preferences of collared female bears and their offspring.
    a) On an individual home range basis where a grizzly and a black bear overlap, and
3. Evaluate bear food habits in terms of plant phenology.

Results:

The student investigator is writing his thesis. Completion is scheduled for late summer-early fall.

Productivity, Nest Site Characteristics, and Food Habits of Long-eared Owls in the Snake River Birds of Prey Area

Project Leader:	B. R. McClelland
Student Investigator:	J. S. Marks
Cooperators:	Bureau of Land Management, Snake River Birds of Prey Research Project; New Jersey Raptor Association

Objectives:

1. To determine the nesting density and annual productivity of Long-eared Owls in the Birds of Prey Area.
2. To determine the influence of nest site characteristics on the nesting success of Long-eared Owls.
3. To determine the food habits of nesting Long-eared Owls.

Results:

The student investigator is continuing to analyze data and prepare the thesis. Three of 5 manuscripts that will comprise the thesis are completed. Abstracts will appear in a subsequent biannual report.

The Food Habits of and Habitat Selection by a Barren Ground Grizzly Female and Cubs, Brooks Range, Alaska

Project Leader:	B. W. O'Gara
Student Investigator:	J. Hechtel
Cooperators:	Alaska Department of Fish and Game, Naval Arctic Research Laboratory, National Wildlife Federation, Wildlife Management Institute, National Audubon Society, Theodore Roosevelt Memorial Fund of the American Museum, Arctic Institute of North America

Objectives:

1. To examine in detail the seasonal food habits of a female grizzly and her two offspring, and to provide a general account of bear food

habits on the western North Slope.
2. To determine daily movement and activity patterns, seasonal movements and the home range of the bears.
3. To describe and map portions of habitat within the home range of the family group.
4. To determine the seasonal habitat use patterns of the bears.
5. To conduct qualitative analysis of important bear food items.

Results:

The student investigator is working in Alaska and working on his thesis.

Characteristics of a Hunted Mountain Lion Population (Felis Concolor) in Western Montana

Project Leader:	B. W. O'Gara and K. G. Greer
Student Investigator:	K. M. Murphy
Cooperators:	Montana Department of Fish, Wildlife and Parks, National Rifle Association, US Forest Service

Objectives:

1. To examine age structure, density, natality, and the distribution of mountain lions in hunted and unhunted drainages of the study area.
2. To investigate hunting pressure and harvest of mountain lions in the study area, and relate those data to population characteristics.
3. To determine timing and distance of dispersal by young animals and the age of sexual maturity in males.
4. To identify and describe winter habitat requirements of mountain lions in the study area, specifically those relating to the aquisition of prey.

Results:

The student has completed his thesis. An abstract of results will appear in the next biannual report.

Ecology of the Bobcat in a Coniferous Forest Environment

Project Leader:	I. J. Ball
Student Investigator:	D. Smith
Cooperators:	Montana Department of Fish, Wildlife, and Parks

Objectives:

1. Describe overall status of western Montana bobcat populations and evaluate their structure and dynamics.
2. Characterize habitat requirements, home range, and general movements.
3. Delineate reproductive processes and relate them to the state of overall population.
4. Evaluate food preferences by stomach analyses and scats.
5. Suggest management options based on the results of this study which could improve management of bobcats.

Results:

The student investigator is writing his thesis. The Abstract should appear in the next Biannual.

Habitat Selection, Breeding Biology, and Density of the Mountain Plover (*Charadrius montanus*) on the Charles M. Russell National Wildlife Refuge

Project Leader:	I. J. Ball
Student Investigator:	S. Olson
Cooperators:	US Fish and Wildlife Service, Charles M. Russell National Wildlife Refuge

Objectives:

1. Determine the average nesting densities in several representative black-tailed prairie dog towns used by Mountain Plovers and determine the number and distribution of towns used by Mountain Plovers on the Refuge.
2. Determine the nesting success and productivity of these birds.
3. Quantify differences in insect densities and species distribution between prairie dog towns used by Mountain Plovers and adjacent areas.
4. Record general behavior, with special attention given to polyandrous behavior and

multiple clutches within breeding pairs.

Results:

The student investigator is working for the U.S. Fish and Wildlife Service. Her Abstract should appear in the next Biannual.

Habitat and Status of the Rocky Mountain Goat in the Snake River Range, Idaho

Project Leader:	B. W. O'Gara
Student Investigator:	J. A. Hayden
Cooperators:	Idaho Department of Fish and Game; US Forest Service, Targhee National Forest

Objectives:

1. Estimate the present number and age and sex composition of the goats inhabiting the Snake River Range.
2. Determine their present distribution and use of seasonal ranges.
3. Identify high-use (key-habitat) areas and describe them according to selected physical characteristics.
4. Locate nearby suitable habitat with similar characteristics to those of the high-use areas.
5. Establish permanent ground census routes to facilitate the continuation of population monitoring.
6. Develop management guidelines for the Snake River Range goat population.

Results:

The student investigator spent all of fall and winter quarters in the field. He will return to take courses after Christmas holidays.

Population Dynamics and Social Systems of Exploited and Unexploited Bobcat Populations in Southeastern Idaho

Project Leader:	I. J. Ball
Research Technician:	S. T. Knick
Cooperators:	U.S. Department of Energy, Idaho Department of Fish and Game

Objectives:

1. Determine the effects of hunting and trapping on the social organization and population dynamics of bobcats.

2. Document kitten:female dependency period and how mortality in adult females affects subsequent vulnerability of the kittens to natural and harvest mortality. Establish distance and direction of dispersal by kittens.

3. Measure home range use by denning females and determine food requirements of raising kittens in relation to kitten survival and recruitment to the population.

4. Describe food habits in relation to prey abundance.

5. Test the validity of scent station or other population indices with a known density population.

Results:

Field work continued throughout the period. The technician has been accepted into a Ph.D. program, and will start classwork in January, 1984.

Habitat Preference and Nest Success of Upland Nesting Ducks on Bowdoin NWR

Project Leader: I. J. Ball
Student Investigator: J. Holm
Cooperators: Bowdoin NWR
Montana Dept. FWP

Objectives:

1. To determine current condition and trend on the major range sites found on the refuge.
2. To determine nesting densities of upland nesting ducks relative to range site and condition.
3. To determine species nesting success relative to range site and condition.
4. To identify major elements affecting nesting success.
5. To identify nest predators and determine overall loss to predation.
6. To identify significant production loss during the pre- and post-nesting periods.

Results:

The project is in its second season with the first drag starting on 7 May and ending on 6 June. A total of 100 duck nests have been found as of this writing. The second drag will start on 8 June. The student investigator will work through mid-August and attend classes during Fall quarter.

Movements, Food Habits, and Radionuclide Transport by Black-tailed Jackrabbits on the INEL Site

Project Leader: I. J. Ball
Student Investigator: J. C. Grant
Cooperators: US Department of Energy - INEL Site

Objectives:

1. Document the number of jackrabbits utilizing a radiation waste disposal site on a seasonal basis.
2. Determine daily and seasonal movement patterns of jackrabbits on and around the site.
3. Determine food habits of jackrabbits on and

around the site and describe habitat components of the site that attract rabbits.

In collaboration with RESL Radioecologists:

4. Document exposure and radionuclide concentrations in jackrabbits on the site and on a control area.
5. Model radionuclide transport away from the site by jackrabbits.
6. If possible, determine forage intake rates by jackrabbits, and document the role of predators in secondary transport of radionuclides.

Results:

The student investigator spent winter and spring quarters taking courses.

Grizzly Bear Habitat Evaluation and Integration of Habitat Mapping Systems in the Bob Marshall Wilderness

Project Leader:	B. W. O'Gara
Student Investigator:	R. D. Mace
Cooperators:	US Fish and Wildlife Service, US Forest Service, Flathead National Forest

Objectives:

1. Delineate and describe grizzly bear habitat components within the study area.
2. Develop a stratified grizzly bear habitat classification system using existing systems and implementation of habitat components.
3. Develop a predictive model of grizzly bear seasonal distribution and habitat use based on food availability within the classification.
4. Generate a map of the stratified system for the study area.

Results:

The student investigator spent the quarter taking courses and has returned to the field for the second season.

Evaluating Elk Habitat in Terms of Cover in Central Idaho

Project Leader:	B. W. O'Gara
Student Investigator:	N. K. Lee
Cooperators:	U. S. Forest Service, Payette National Forest

Objectives:

1. Determine percentage of cover (cover index) for timber PI types (strata) on the Payette National Forest.
2. Determine amount of elk use in relation to cover and habitat type.
3. Determine elk use in relation to juxtaposition of surrounding timber stands and distance from roads.
4. Correlate cover index to past timber management activities.

Results:

The student investigator has completed most of her course work.

The 1983 field season will run from June to December. Information will be gathered from many samples of each PI type (timber strata) present. The habitat will be evaluated by determining the percentage of cover provided and the elk use in each area. Additional information to be obtained includes includes distance of area from roads, distance from surrounding areas and PI type of surrounding areas, habitat type, and physical features of the area.

Upon completion of the field season, data will be analyzed and the student will begin writing her thesis.

Distribution and Habitat Utilization by Mule Deer

Project Leader:	B. W. O'Gara
Student Investigator:	S. K. Kraft
Cooperators:	The Montana Power Company, Montana Department of Fish, and Parks

Objectives:

1. Determine distribution and habitat utilization patterns of mule deer on lands adjacent to the Carter Ferry Project.
2. Document movement patterns of mule deer, including winter and summer home ranges, activity centers, daily movement patterns and seasonal migrations.
3. Evaluate habitat quantity, quality and intensity of use.
4. Interpret biological data in reference to potential impacts of the project, contributing to the development of a comprehensive plan for mitigation.

Results:

Helicopter drive netting and net gunning were utilized on 5, 6, and 10 January and on 13 February to capture 20 adult mule deer does that were fitted with radio telemetry collars and 20 additional deer that were marked with white neck collars. All 20 radioed deer have remained on the study area throughout the winter and spring. The student recorded 270 winter and 130 spring locations. Approximately 95% of all locations were above the 2820 ft. proposed reservoir inundation level. Three-fourths of the study area was censused on 21 March under poor (patchy snow) conditions. A total of 609 deer was observed including 11 of 33 marked deer present on this portion of the study area.

The student is in the field this summer and is continuing to monitor radio-collared deer movements and habitat use patterns, using pellet transects to collect additional elevation/habitat use data, and gathering basic vegetation community information to be used to determine habitat availability versus use in the area.

Beaver Populations on Impounded and Unimpounded Rivers: Densities, Habitat Profiles, and Mitigation Strategies

Project Leader:	B. W. O'Gara
Student Investigator:	R. Bown
Cooperator:	Montana Power Company

Objectives:

1. Determine current population levels and patterns of habitat use of beavers on the Carter Ferry study area.
2. Predict the effect of anticipated water levels

on the availability of potential beaver habitat after completion of the proposed Carter Ferry Dam, and identify possible mitigation measures.

3. Compare population densities of beavers on impounded and unimpounded segments of rivers in Montana.
4. Develop a "profile" of occupied beaver habitat along impounded and unimpounded segments.
5. Characterize occupied beaver habitat in impounded segments for use in planning mitigation.

Results:

The student investigator completed the first survey of the Carter Ferry Site and Morony Dam Reservoir. Eleven active and 1 possibly active colonies were located on the Missouri River between Morony Dam and Carter Ferry. Three additional colonies were found on the lower 3 km of Highwood Creek. Four active colonies were located on the first 10 km of Missouri River below Carter Ferry.

One colony was located in the powerhouse outflow of Ryan Dam, just above the Morony Dam Reservoir level. No colonies were found on the reservoir itself, though a complex of beaver dams exists on a side creek just above the reservoir level.

In June, the student conducted an aerial survey of nearby reservoirs and river segments looking for additional study areas comparable to the proposed Carter Ferry Reservoir. The aerial survey will be followed by ground reconnaissance.

White-tailed Deer Winter Habitat Selection in a Second Growth Forest

Project Leader:	B. W. O'Gara
Student Investigator:	K. L. Berner
Cooperators:	Montana Forest and Conservation Experiment Station

Objectives:

1. To describe white-tailed deer winter range in terms of canopy closure, stand density, diameter distributrion, successional stage, horizontal and vertical structure, and habitat type.
2. To separate winter habitat use into the following categories.
   A. Adult and yearling deer

    B. Feeding, bedding, and travel activities
    C. Day and night use
3. To delinineate winter home ranges for collared deer.
4. To identify winter ranges and seasonal movements.

Results:

The student investigator was enrolled in classes during the winter and spring quarters. White-tailed deer winter concentration areas were located with the aid of volunteer technicians. Efforts to radio-collar female whitetails were unsuccessful, however two males were trapped on six different days. Poor snow conditions prohibited backtracking data collection. Spring use areas were delineated. Plans were developed for habitat mapping and description.

Tests of Repellents and Deterrents For Bears

Project Leaders: C. Jonkel and B. O'Gara
Student Investigator: C. Hunt
Field Assistants: Martin Smith, Annette Heidelberg, David Horning, Alicia Hunt,
Cooperators: Montana Department of Fish, Wildlife and Parks; National Park Service; U.S. Forest Service, Flathead National Forest; Confederated Salish and Kootenai Tribes, Flathead Reservation; British Columbia Fish and Wildlife Branch; National Rifle Association; Bear Country Products

Objectives:
1. To systematically test substances and devices that may deter or repel grizzly (*Ursus arctos*) and black (*U. americanus*) bears and which: a) can be carried and used by persons likely to encounter bears; b) can be left at a camp, cabin, picnic area, garbage dump, remote station, etc.;
2. To describe the behavioral responses of captive bears to tests of various claimed or potential repellents and deterrents; and

3. To describe the behavioral responses of free-ranging bears as they encounter a) products or techniques which give positive responses in the laboratory tests, and b) other claimed or potential repellents and deterrents.

Results:

The student began work on the project in June 1981. Complications with funding and logistics delayed most of the field work until June 1982. Testing was completed in December 1982.

Four black bears and one grizzly bear were tested in the laboratory at Fort Missoula, Missoula, MT. These animals were captured as a result of livestock or property damage they had caused and were destined to be destroyed or relocated.

Stimuli tested were: Halt (a dog repellent containing red pepper),railroad flares, a suddenly-opened umbrella, a skunk mercaptan spray (manufactured by Bear Country Products), and a combination of the skunk mercaptan and the Halt. Of these, the Halt and the skunk-Halt combination may be effective in repelling bears in a charge situation.

Twenty-five bears were tested at the Sparwood sanitary landfill site in British Columbia. The student ear-tagged 9 of these for positive identification at night. Only 3 of the remaining bears were difficult to distinguish from each other.

Stimuli tested included: Halt, Boundry (commercial dog deterrent), mothballs, ammonia (2 types), male and female human urine, the skunk mercaptan spray, and Technichem (potential commercial bear deterrent). The Halt and skunk mercaptan were delivered from a remotely triggered device. Attempts to test bears with rock salt fired from a shotgun were discontined when shells with the necessary range and accuracy could not be assembled. Only the Parson's Ammonia and the Halt appeared to be effective in deterring bears from the baits.

During winter 1982, the student attended classes and compiled an annotated bibliography for Glacier National Park on deterrents, aversive conditioning, and other practices that may aid in bear management.

During summer 1983, the student will concentrate on data analysis and writing the thesis report. She will also supervise Martin Smith, who plans to continue with the study as his senior thesis project in Wildlife Biology at the University of Montana.

CONSERVATION, EDUCATION, AND PUBLIC RELATIONS

Bart O'Gara

	Spent about 30 hours evaluating applicants for 2 new Forestry/Wildlife positions and about 20 hours evaluating elk habitat for the F.S. Range Experiment station by the Delphi and Q-sort methods.
	Reviewed a 318 page M.S. for Sierra Books, a 552 page book for the Quarterly Review of Biology, a 67 page M.S. for the F.S. Fire lab, and 26 pages for the TWS Bulletin.
12 January	Conducted a wolf recovery meeting with personnel from USFWS and USFS in Missoula.
14 January	Conferred with Washington Department of Game and WashingtonState University personnel regarding capture techniques for elk. Also attended planning meeting for U.M. Forestry Department.
19 January	Presented a paper on Northern Rocky Mountain Wolf Recovery at the Western Section, Montana Chapter of the Wildlife Society.
25 January	Lectured on old world wildlife to U.M. Mammal Conservation class (60 students).
9-10 February	Attended Montana Chapter meeting TWS in Missoula.
15 February	Participated in steering committee meeting for the Mission oriented research program.
16 February	Gave a talk on "1080 fact and fiction" to a public meeting sponsored by The Montana Student Chapter of TWS (about 75 people attended).
17 February	Lectured to Forestry School mammal management class on management of pronghorns.
22 February	Participated in Forestry School planning committee meeting.
23 February	Attended a Forest Service/Friends of the Rattlesnake meeting and discussed the potential impacts of Forest Service plans on wildlife in the Rattlesnake National Recreation area.

5 March	Attended Pacific Bird and Mammal Society meeting in Missoula.
9 March	Lectured on African game ranching to a Forestry class (about 50 undergraduates).
15 March	Served as banquet speaker at Missoula Chapter of the American Society of Foresters annual meeting. Gave a slide presentation on wildlife management and hunting in Eurasia (about 100 foresters and their guests).
16 March	Participated in a Steering Committee meeting for The Mission Oriented Research Program.
17 March	Netted and radioed three mountain sheep for the Bitterroot Forest.
17 March	Served as banquet speaker at the monthly meeting of the Missoula Dental Association. Gave a slide presentation on wildlife management and hunting in Eurasia (about 30 dentists).
3 April	Met with MTFWP administrators on the Wolf Recovery Plan.
7 April	Met with administrators from MTFWP, MSU, and UM on the Unit threat.
18 April	Met with UM personnel on the Mission Oriented Research Program.
20 & 29 April	Met with UM personnel on the possible reorganization of the Life Sciences Program.
25 April	Met with new ADC personnel to familiarize them with identification of predator kills.
27 April	Spoke to the Hamilton Kiwanis Club about hunting in Russia and Mongolia, and to a high school class (45 students) on game ranching and management in South Africa.
18 May	Spent the day talking to students (35) at the Superior Outdoor School about Wildlife Research.
23 May	Met with sheep producers and environmental groups in Great Falls to discuss the Northern Rocky Mountain Wold Recovery Plan.

30 June	Spent all day taking 23 Senior Citizens around the Bison Range.

JOE BALL

19 January	Planned and hosted a Western Section, Montana Chapter meeting of the Wildlife Society. The session included a workshop on Mitigating the Effects of Mineral Exploration and Development.
9-10 February	Attended Montana Chapter meeting TWS, and reported on the Western district meeting concerning "Mitigating the Impact of Mineral Exploration and Development on Wildlife".
March	Was elected Vice President of the N.W. Section of the Wildlife Society.
3 March	Lectured on the lead vs. steel shot controversy to UM Bird Management class (35 students).
4 March	Lectured to UM Wildlife Management course on basic population management (50 students).
7 March	Lectured to UM Wildlife Management course on basic population management (50 students).
21-25 March	Conducted a continuing education course, Evaluation and Management of Wildlife Habitat. The course was attended by 36 managers and biologists from state, federal, and province agencies. Participants rated the course at 3.6 on a 4.0 scale for material presented and 3.7 for organization.
26-29 April	Met with FWS and State personnel in Jamestown, N.D. on the Mallard Recruitment Study.
24-25 May	Attended eastern Montana wetland tour to discuss duck recruitment studies.
	Reviewed an 8 page and 14 page M.S. for the TWS Bulletin.

ROSE LEACH

11 February	Presented a paper on "Summer Range Ecology of white-tailed deer" at Montana TWS meeting.

SUSAN KRAFT

11-13 February	Attended Western States Mule Deer Workshop in Spokane.
11-14 February	Attended the NW Section TWS annual meeting in Spokane.
29 April	Spoke to a group of Cub Scouts on Wildlife research and conservtion.

DAN POND

4 May	Presented a paper to the NW Section of Forensic Scientists: Sex Determination from Big Game Meat Samples.
19 May	Lectured to a UM Wildlife class on Forensic Science.
27 May	Talked to Missoula grade school classes all day about predation.

KEVIN BERNER

February	Attended Mont. Chapter TWS annual meeting in Missoula.
11-13 February	Attended the Mule Deer Workshop in Spokane.
14-15 February	Attended the NW Section TWS annual meeting in Spokane.

HARRY CARRILES

18-22 February	Attended the 6th International Conference on Bear Research and Management, Grand Canyon, Arizona. Presented a poster session on drugging bears with a blowgun.

JOHN GRANT

February	Attended the Montana Chapter TWS annual meeting in Missoula.
14-15 February	Attended the NW Section TWS annual meeting in Spokane.

CARRIE HUNT

18-22 February	Attended 6th International Conference on Bear Research and Management, Grand Canyon, Arizona. Participated in the poster session.
May	Gave a slide presentation on the Yellowstone Grizzly Bear project to the Missoula chapter of the Sierra Club.
May	Lectured on bear ecology and research techniques at the Rattlesnake School Campout.

RICK MACE

	Presented a slide show on grizzly bear habitat in the Bob Marshall Wilderness to U.S. Forest Service personnel at Hungry Horse, Montana.
18-22 Feb.	Attended the 6th International Conference on Bear Research and Management, Grand Canyon, Arizona. Presented a paper on food habits of grizzly bears in Montana.
	Attended a grizzly bear population trend monitoring workshop in Kalispell, Montana.
	Presented a seminar at the grizzly bear habitat monitoring seminar in Missoula, Montana.

RANDY MATCHETT

15 March	Presented a slide show to 30 Yaak Valley residents concerning the Yaak Moose study.

KERRY MURPHY

14-15 February Attended the NW Section TWS annual meeting in Spokane and presented a paper on mountain lion research.

ANDY SHELDON

Attended the annual meeting of the Benthological Society, La Crosse, Wisconsin. Presented a paper: Perlid Stoneflies in an Appalachian Watershed: 2 Multivariate Approach to Mapping Stream Communities.

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Montana Cooperative Wildlife Research Unit

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USDI Fish and Wildlife Service, University
of Montana, and Wildlife Management
Institute cooperating.

BIANNUAL REPORT-~~Dec. '81 - June '82~~
July to December 1982

BIANNUAL REPORT

of the

MONTANA COOPERATIVE WILDLIFE RESEARCH UNIT

University of Montana

Missoula, Montana

to

UNIVERSITY OF MONTANA

MONTANA FISH, WILDLIFE AND PARKS DEPARTMENT

WILDLIFE MANAGEMENT INSTITUTE

U.S. FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR

Vol. 33, No. 1
July - December 1982

Respectfully Submitted,

Bart O'Gara
Bart W. O'Gara, Leader

Ball
Joe Ball, Ass't Leader

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MONTANA COOPERATIVE WILDLIFE

RESEARCH UNIT PERSONNEL

Coordinating Committee

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W. Leslie Pengelly, University of Montana, Missoula
Bart W. O'Gara, U.S. Fish and Wildlife Service, Missoula

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Joe Ball, Assistant Leader
John J. Craighead, Affiliate in Zoology and Forestry
John T. Harris, Forestry School
Donald A. Jenni, Zoology Department
Charles Jonkel, Forestry School and Montana Fish, Wildlife and Parks Department
Lee H. Metzgar, Zoology Department
W. Leslie Pengelly, Forestry School
Robert R. Ream, Forestry School
Andrew L. Sheldon, Zoology Department
Philip L. Wright, Zoology Department
"Ginger" Schwarz, Unit Secretary

Graduate Students

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Robin Bown
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Harry Carriles
John Grant
Rich Harris
Jim Hayden
John Hechtel
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Nancy Lee
Tim Lingel-Pate
Rick Mace
Jeff Marks
Randy Matchett
Jo Meeker
Kerry Murphy
Sally Olson
Dan Pond
Drew Smith
Darrel Weybright
Bob Yeager

COOPERATING AGENCIES

University of Montana
Montana Fish, Wildlife, and Parks Department
Wildlife Management Institute
U.S. Fish and Wildlife Service

Alaska Department of Fish and Game
Alberta Fish and Wildlife Division
American Petroleum Institute
Arctic Institute of North America
Border Grizzly Project
Bowdoin National Wildlife Refuge
Bureau of Indian Affairs
Bureau of Land Management
Bureau of Reclamation, Lower Missouri Region
Charles M. Russell National Wildlife Refuge
Colorado Division of Wildlife
Confederated Salish and Kootenai Tribes
Denver Wildlife Research Center
Double Four Corporation
Echo Bay Mines Limited
Idaho Department of Fish and Game
Missoula County Rodent Control Board
Montana Department of Agriculture
Montana Forest and Conservation Experiment Station
National Audubon Society
National Bison Range
National Hispanic Scholarship Fund
National Rifle Association
National Wildlife Federation
Naval Arctic Research Laboratory
New Jersey Raptor Assocaition
Parks Canada
Rocky Mountain Forest and Range Experiment Station
Sheldon-Hart National Wildlife Refuge
Sigma Xi
Theodore Roosevelt Memorial Fund of the American Museum
University of Wyoming
U. S. Forest Service (Custer, Kootenai, Flathead, Targhee Forests)
U. S. Department of Energy (INEL Site)
U. S. National Park Service (Glacier, Yellowstone Parks)
Utah Division of Wildlife Resources
Wildlife-Wildlands Institute

RESEARCH PROJECTS

Physiologic and Ecologic Studies of the Pronghorn (Antilocapra americana)

Project Leader: B. W. O'Gara

Cooperators: National Bison Range, U.S. Fish and Wildlife Service; Yellowstone National Park,U.S. National Park Service; and the Montana Fish, Wildlife and Parks Department

Objectives:

To study:

1. the reproductive physiology of male and female pronghorn;
2. the physiology and function of scent glands;
3. food habits related to changes in range conditions;
4. horn growth and casting; and
5. the relationships of pronghorns to other artiodactyls.

Results:

Work was continued on the pronghorn book.

Population Studies of Canada Geese in the Flathead Valley

Project Leaders: J. J. Craighead and I. J. Ball

Cooperators: USFWS, Montana Dept. Fish, Wildlife and Parks, BIA/Confederated Salish & Kootenai Tribes

Objectives:

1. To gather current data on populations, nesting areas,and nest success of Flathead geese.
2. To compare the current situation with conditions documented during 1953-60.
3. To relate changes in reproductive output of the geese to changes in habitat or management strategies since the 1950's.
4. To prepare a monograph using both historical and current data.

Results:

Availability of funds and key personnel allowed a third replicate to be completed this spring. Target date for a draft of the monograph is December 1983.

ABSTRACT

Hogg, John T. Zoology

A Study of Social Organization, Social Behavior, and Reproduction in Rocky Mountain Bighorn Sheep on the National Bison Range, Moiese, Mt.

Director: D. A. Jenni

Published, biological objections to the trophy hunting of bighorn sheep (Ovis canadensis) are briefly reviewed. The remainder of the report presents control period data, collected during 3 years (1979-1982), for the eventual test of two of these objections: the magnet and social disturbance hypotheses. These control data will be compared to similar data from a future experimental period when trophy rams are removed from the same herd. The test of both hypotheses will be two-pronged: first, does bighorn behavior change in the predicted fashion and, second, do these changes adversely affect reproduction and survival? Briefly, the magnet hypothesis suggests that trophy males prevent prolonged and costly (in terms of ewe reproduction and survival) associations between young rams and ewes. Measures of intersexual association are presented for spring/summer, rut, and winter. Data on ewe reproductive effort (lamb weights and suckling time), estrous cycles, and ewe and lamb mortality are also tabulated. Several variants of the social disturbance hypothesis are discussed. All suggest that the absence of trophy males will alter the normal development of mating associations during rut, leading, in the extreme, to decreased reproduction and increased lamb and ewe mortality. Control data are presented on the structure and stability of ram dominance hierarchies, copulation rates by tending and satellite rams, interference rates by satellite rams, conception rates, estrous schedules, ewe reproductive effort, and lamb and ewe mortality. Finally, data are presented on population structure, size, sex ratio, age structure, and ram horn size class distribution to allow experimenters to choose the trophy hunting regime they wish to simulate with trophy ram removal.

ABSTRACT

Pond, Daniel B., M.S., Fall 1982 Wildlife Biology

The Pathology and Cross-Infectivity of Sarcocystis spp. in Mule Deer, White-tailed Deer, and Elk (39 pp.)

Director: Bart W. O'Gara

Sarcocystis from mule deer, white-tailed deer, and elk was passed through coyotes, yielding 2 distinct types of sporocysts. Sporocysts of S. hemionilatrantis measuring 16.2 X 9.9 μm were common to all intermediate hosts, and another Sarcocystis sp. measuring 19.3 X 12.7 μm was passed only after eating elk meat. These sporocysts were fed to 12 mule deer fawns divided into 4 groups, each receiving sporocysts from 1 intermediate host with 1 control group. Those fawns receiving sporocysts developed acute sarcocystosis. Clinical symptoms started 11 days post infection and included anorexia, pyrexia, weight loss, wet cough, hair loss, and sloughing of the ears, tail, and glans penis. Only SGPT, SGOT, and CPK levels in the blood became elevated during the experiment. Three fawns died of congestive heart failure and 1 was moribund before being killed. The experiment was ended after 49 days. All fawns showed signs of congestive heart failure, lymphadenitis, meningoencephalitis, endocarditis, and hyperplasia of the spleen and liver. The primary lesions occurred in skeletal muscle and included perivascular necrosis with a mononuclear cell infiltration, edema, and degeneration of muscle tissue. Schizonts at various stages were seen in the skeletal and heart muscles of all fawns and in the adrenal glands or lungs of 3 others. No cyst formation was seen. Three pregnant mule deer does and 1 pregnant elk from the NBR were grossly infected with Sarcocystis. Cysts ranged in size from 0.2 mm X 0.4 mm to 0.4 mm X 1 mm. Light microscopy showed that cysts had prominent walls with septae compartmentalizing bradyzoites and metrocysts within the cyst. Electron microscopy revealed 1 cyst wall type common to both species of deer and elk and a second cyst wall type in elk only. Muscle digestion of 6 fetal mule deer and 1 fetal elk revealed a congenital infection in 1 deer fetus. Apparently S. hemionilatrantis infects mule deer, white-tailed deer, and elk; and a second unidentified Sarcocystis sp. infects elk.

Pronghorn Antelope Behavior in Northwestern Nevada - Southeastern Oregon

Project Leader: B. W. O'Gara
Student Investigator: J. O. Meeker
Cooperators: Sheldon-Hart National Wildlife Refuge, Double Four Corporation, NRA

Objectives:

1. To determine seasonal movements of pronghorns (*Antilocapra americana*) that summer on Hart Mountain and Sheldon Antelope Refuges.
2. To determine breeding strategies used by pronghorn with home ranges in two habitat types (Low Sage-Bunchgrass and Playa).
3. To analyze any differences noted in objective 2 above in an ecological and behavioral framework.
4. To determine trace element content of vital organs and hair of pronghorn taken at Sheldon and Hart Mountain Wildlife Refuges.
5. To establish trace element baseline data for pronghorns at Sheldon and Hart Mountain Wildlife Refuges.
6. To compare trace element data from Sheldon and Hart Mountain with hair taken from Idaho and Montana pronghorns.

Results:

Field data collection was terminated on 15 September 1982. Three years of movement and breeding habit data collection were completed at that time.

The tissue and hair samples collected during the fall of 1982 were prepared for analysis. The student investigator encountered problems associated with the accurate determination of selenium content of tissue and hair samples. A decision was made to consolidate individual samples into year and location composite samples and to locate a facility away from the University of Montana where accurate determination of selenium content could be made. The student investigator is presently conducting negotiations with Washington State University concerning this matter.

Winter Ecology of Mule Deer in the Rattlesnake Gulch Area

Project Leader:	I. J. Ball
Student Investigator:	R. Yeager
Cooperators:	Confederated Salish and Kootenai Tribes, Bureau of Indian Affairs, National Rifle Association

Objectives:

1. Document the relative importance of various habitat types to the mule deer that winter in the Rattlesnake Gulch Area.
2. Describe movement patterns of the deer and distribution on the winter range.
3. Estimate population size and age/sex composition.

Results:

The thesis is in the final stages of completion. An abstract will appear in the next biannual report.

Effects of Subdivisions and Grazing on Grant Creek Wild Ungulates

Project Leader:	B. W. O'Gara
Student Investigator:	D. Weybright
Cooperators:	Montana Department of Fish, Wildlife and Parks, National Wildlife Federation

Objectives:

1. To determine ungulate numbers, concentration areas, and migration routes on a traditional winter range prior to subdevelopment.
2. To determine forage production, utilization and range condition.
3. To document the process of subdevelopment and cattle grazing and make recommendations to minimize the negative impacts.

Results:

The student investigator was in the field summer and fall. Data were collected to determine forage production and utilization by 60 cow/calf pairs grazing the winter range. A pellet group count was taken to help define areas of ungulate concentrations. Monitoring 9 radio-marked elk and 6 radio-marked deer continued and will terminate this winter as the animals return to the winter range. Permanant transects were established on 5 locations to aid monitoring of range trend.

The student is currently involved in data analysis, the thesis will be completed by June, 1983.

Recovery of a Ground Squirrel Population Following Applications of 1080 and Effects of the Poisoning Program on Coyotes

Project Leader:	B. W. O'Gara
Student Investigator:	T. Lingel-Pate
Cooperators:	Montana Department of Argiculture, Environmental Management Division; Missoula County Rodent Control Board; Montana Department of Fish, Wildlife and Parks; US Fish and Wildlife Service, Denver Research Center

Objectives:

1. Measure the degree of ground squirrel reduction achieved by 1080 poisoning.
2. Quantify reproductive performance in treated and untreated ground squirrel populations.
3. Compare dispersal rates of young (juvenile and yearling) squirrels between treated and untreated populations.
4. Identify the source of immigrants that appear on treated areas.
5. Measure coyote population fluctuations on treated and control areas.
6. Investigate utilization of poisoned squirrel carcasses by ravens and coyotes, and associated mortality.

Results:

The student investigator completed his final field season between 15 April and 10 September 1982. Ground squirrel density estimates were determined for treated areas to quantify the degree of recovery one year after 1080 treatment. One study plot was poisoned on 6 May 1982 to determine the feasibility of beginning 1080 treatments in May rather than June. Reproductive data were collected for 42 females from normal populations and 34 females from reduced populations. An additional 102 squirrels inhabiting unpoisoned areas adjacent to treated fields were marked during 1982 bringing the total number to 397. Six of those squirrels were recaptured on treated fields during 1982. Coyote transects on the treatment and control sites were examined eight times between 2 June and 3 September 1982.

Preliminary data analysis was completed in November and a progress report was submitted to cooperating agencies on 6 December 1982. The student is currently finalizing his data analysis and writing his thesis. An abstract will appear in the next biannual report.

Moose-habitat Relationships in the Yaak Country, Northwestern Montana

Project Leaders:	L. Metzgar and J. Ball
Student Investigator:	R. Matchett
Cooperators:	US Forest Service, Forest and Range Experiment Station: Kootenai National Forest, and Montana Department of Fish, Wildlife and Parks

Objectives:

1. Document seasonal habitat selection by moose in representative portions of the Yaak Country.
2. Assess the impacts of logging on moose habitats, populations, and behavior.
3. Describe seasonal movement patterns of moose.
4. Develop guidelines for logging that will optimize benefits and minimize disturbance to moose.

Results:

The student investigator was in the field from 23 June until 15 September. Two more moose were fitted with radio collars in June yielding a total of 8 marked moose. During the summer, 1 moose lost her collar, 1 transmitter failed, and a yearling bull moved into Canada and thus was unavailable for ground radio-tracking. He was shot by a Canadian hunter in November and the collar was returned. One hundred and ninety radio-locations were recorded for the remaining 5 moose. Moose sightings were recorded 95 times and individual identification efforts were continued.

The student took courses during fall quarter.

Field work will resume in January. Emphasis for the winter field season will be to instrument 3 more moose, radio-tracking, monitoring snow conditions, and retrieval of pertinent data from the Kootenai Forest's data base. Radio tracking will continue through next spring and summer. Ground checking of Forest Service data and additional habitat data collection will begin in the spring.

Grizzly/Black Bear Interactions and Competition

Project Leader:	C. Jonkel
Student Investigator:	H. Carriles
Cooperators:	US Fish and Wildlife Service, Wildlife Management Institute, National Rifle Association, US National Park Service, Montana Department of Fish, Wildlife and Parks, US Forest Service; University of Montana, National Hispanic Scholarship Fund

Objectives:

1. Determine similarities and/or differences between grizzly and black bear food habits from scat analysis.
2. Compare the habitat component preferences of both species:
    a) On an individual home range basis where a grizzly and a black bear overlap, and
    b) by differences between species within the study area.
3. Evaluate grizzly and black bear food habits in the context of phenology, productivity, and nutrient content of certain important plant foods.
4. Compare the feeding strategies of both species. Identify and investigate temporal and/or spacial seperation or exclusion on preferred feeding sites.

Results:

The student investigator is writing his thesis. The abstract should appear in the next biannual.

Productivity, Nest Site Characteristics, and Food Habits of Long-eared Owls in the Snake River Birds of Prey Area

Project Leader: B. R. McClelland
Student Investigator: J. S. Marks
Cooperators: Bureau of Land Management, Snake River Birds of Prey Research Project; New Jersey Raptor Association

Objectives:

1. To determine the nesting density and annual productivity of Long-eared Owls in the Birds of Prey Area.
2. To determine the influence of nest site characteristics on the nesting success of Long-eared Owls.
3. To determine the food habits of nesting Long-eared Owls.

Results:

The student investigator is continuing to analyze data and prepare the thesis. Three of 5 manuscripts that will comprise the thesis are completed. Abstracts will appear in a subsequent biannual report.

Reproductive Ecology and Habitat Utilization by Richardson's Merlins in Southeastern Montana

Project Leader: I. J. Ball
Student Investigator: D. M. Becker
Cooperators: US Forest Service, Rocky Mountain Forest and Range Experiment Station, Custer National Forest

Objectives:

1. To locate active nests and describe habitat utilization by quantifying features of nesting and hunting habitat.
2. To determine reproductive success and possible effects of various chemical pollutants on reproduction.
3. To determine timing and duration of nesting activities.
4. To determine prey utilization.
5. To recommend management actions for Merlins and their habitat on the study areas.

Results:

Features of nesting habitat were quantified at 44 active nesting sites and at 44 inacitve sites. Habitat utilization was determined for 3 adult breeding male Merlins through radio telemetry studies. Reproductive success was documented at 57 nests. Eggshell weights and eggshell thickness indices of 18 eggs collected on the study area were compared with those variables for 60 Merlin eggshells collected in the northern Great Plains prior to widespread use of pesticides. Observations of timing and duration of nesting activities provided documentation of nesting chronology. During the course of the study, 427 prey items were collected and identified.

Field studies were completed in August 1981. A final report was compiled and submitted to the cooperators. Three manuscripts have been completed and submitted for publication.

The Food Habits of and Habitat Selection by a Barren Ground Grizzly Female and Cubs, Brooks Range, Alaska

Project Leader:	B. W. O'Gara
Student Investigator:	J. Hechtel
Cooperators:	Alaska Department of Fish and Game, Naval Arctic Research Laboratory, National Wildlife Federation, Wildlife Management Institute, National Audubon Society, Theodore Roosevelt Memorial Fund of the American Museum, Arctic Institute of North America

Objectives:

1. To examine in detail the seasonal food habits of a female grizzly and her two offspring, and to provide a general account of bear food habits on the western North Slope.
2. To determine daily movement and activity patterns, seasonal movements and the home range of the bears.
3. To describe and map portions of habitat within the home range of the family group.
4. To determine the seasonal habitat use patterns of the bears.
5. To conduct qualitative analysis of important bear food items.

Results:

The student investigator is working in Alaska and working on his thesis.

Characteristics of a Hunted Mountain Lion Population (Felis Concolor) in Western Montana

Project Leader:	B. W. O'Gara and K. G. Greer
Student Investigator:	K. M. Murphy
Cooperators:	Montana Department of Fish, Wildlife and Parks, National Rifle Association, US Forest Service

Objectives:

1. To examine age structure, density, natality, and the distribution of mountain lions in hunted and unhunted drainages of the study area.
2. To investigate hunting pressure and harvest of mountain lions in the study area, and relate those data to population characteristics.
3. To determine timing and distance of dispersal by young animals and the age of sexual maturity in males.
4. To identify and describe winter habitat requirements of mountain lions in the study area, specifically those relating to the aquisition of prey.

Results:

The student has completed field work and his thesis is in preparation. An abstract of results will appear in the next biannual report.

Ecology of the Bobcat in a Coniferous Forest Environment

Project Leader:	I. J. Ball
Student Investigator:	D. Smith
Cooperators:	Montana Department of Fish, Wildlife, and Parks

Objectives:

1. Describe overall status of western Montana bobcat populations and evaluate their structure and dynamics.
2. Characterize habitat requirements, home range,

and general movements.

3. Delineate reproductive processes and relate them to the state of overall population.
4. Evaluate food preferences by stomach analyses and scats.
5. Suggest management options based on the results of this study which could improve management of bobcats.

Results:

Habitat characteristics were evaluated at 75 relocation sites during summer and fall. Data were collected on 14 habitat variables for subsequent analyses at a later date.

Radio-relocation data are being plotted and coded for computer analysis in early spring.

Intensive ground tracking of female study animals in spring and summer resulted in finding 1 den of 3 kittens approximately 10 days old. This den was located in a small cavity under a fallen snag on a steep talus slope at an elevation of 6,720 feet. Further attempts to locate dens for 3 other females were unsuccessful. Success in locating dens appears to be linked to open habitats and the presence of very young kittens that may cry when the adult leaves.

Field work will be completed by March of 1983 with thesis completion by 1 July.

Habitat Selection, Breeding Biology, and Density of the Mountain Plover (Charadrius montanus) on the Charles M. Russell National Wildlife Refuge

Project Leader:	I. J. Ball
Student Investigator:	S. Olson
Cooperators:	US Fish and Wildlife Service, Charles M. Russell National Wildlife Refuge

Objectives:

1. Determine the average nesting densities in several representative black-tailed prairie dog towns used by Mountain Plovers and determine the number and distribution of towns used by Mountain Plovers on the Refuge.
2. Determine the nesting success and productivity of these birds.
3. Quantify differences in insect densities and species distribution between prairie dog towns used by Mountain Plovers and adjacent areas.
4. Record general behavior, with special

attention given to polyandrous behavior and multiple clutches within breeding pairs.

Results:

The student investigator concluded field work on 1 September 1982. Fall quarter was spent taking course work and starting initial data analysis. The projected completion date of the thesis is Spring 1983.

Habitat and Status of the Rocky Mountain Goat in the Snake River Range, Idaho

Project Leader: B. W. O'Gara
Student Investigator: J. A. Hayden
Cooperators: Idaho Department of Fish and Game; US Forest Service, Targhee National Forest

Objectives:

1. Estimate the present number and age and sex composition of the goats inhabiting the Snake River Range.
2. Determine their present distribution and use of seasonal ranges.
3. Identify high-use (key-habitat) areas and describe them according to selected physical characteristics.
4. Locate nearby suitable habitat with similar characteristics to those of the high-use areas.
5. Establish permanent ground census routes to facilitate the continuation of population monitoring.
6. Develop management guidelines for the Snake River Range goat population.

Results:

The student investigator spent all of fall and winter quarters in the field. He will return to take courses after Christmas holidays.

Population Dynamics and Social Systems of Exploited and Unexploited Bobcat Populations in Southeastern Idaho

Project Leader: I. J. Ball
Research Technician: S. T. Knick
Cooperators: U.S. Department of Energy, Idaho Department of Fish and Game

Objectives:

1. Determine the effects of hunting and trapping on the social organization and population dynamics of bobcats.
2. Document kitten:female dependency period and how mortality in adult females affects subsequent vulnerability of the kittens to natural and harvest mortality. Establish distance and direction of dispersal by kittens.
3. Measure home range use by denning females and determine food requirements of raising kittens in relation to kitten survival and recruitment to the population.
4. Describe food habits in relation to prey abundance.
5. Test the validity of scent station or other population indices with a known density population.

Results:

Twenty-one bobcats have been radio-instrumented and 5 others were ear-tagged in 2 study populations; 1 population is open to harvest and is compared to an unharvested population. Yearling:adult ratios were 4:2 in the harvested population and 3:7 in the unharvested population. Three of the 4 yearlings tagged in the unharvested area left their capture vicinity and moved from 10-50 km away shortly after capture. The 3 yearlings marked in the unharvested area have remained on ranges in their capture vicinity. Litters were raised by all 4 adult females, but not by any of the 5 yearling females despite present high prey population levels in spring and summer 1982. One yearling female was struck by a car and killed. One adult female died of unknown natural causes in September. Her 2 kittens were not captured and kitten tracks have not been observed in their range since; they presumably have not survived. This vacant range (within the unharvested region) has been occupied since November by a yearling female previously tagged in the harvested study area, a movement of 50 km. Jackrabbit populations have begun to decline in both study areas. We will continue to moniter bobcat population parameters, kitten production and survival, blood physiology, and food habits in relation to changing prey abundance.

Habitat Preference and Nest Success of Upland Nesting Ducks on Bowdoin NWR

Project Leader:	I. J. Ball
Student Investigator:	J. Holm
Cooperators:	Bowdoin NWR, Montana Department FWP

Objectives:

1. To determine current condition and trend on the major range sites found on the refuge.
2. To determine nesting densities of upland nesting ducks relative to range site and condition.
3. To determine species nesting success relative to range site and condition.
4. To identify major elements affecting nesting success.
5. To identify nest predators and determine overall loss to predation.
6. To identify significant production loss during the pre- and post-nesting periods.

Results:

The first field season has been completed. Study units comprising thirty percent of each range site were sampled for the presence of nests. A total of 168 duck nests were found. Species composition was as follows: 41% gadwall, 21% northern shoveler, 15% blue-winged teal, 12% lesser scaup, 6% mallard, and 5% pintail. The overall hatch rate using the Mayfield 40% method was 43%. Nest predation was primarily by fox (15), ground squirrels (12), skunk (12), and avian predators (2). Five nests were destroyed as a result of the search effort, 2 nests were abandoned and 1 nest had a complete clutch of addled eggs. The total number of nests failing to hatch was 49.

Preparations are currently underway for the start of the second field season.

Movements, Food Habits, and Radionuclide Transport by Black-tailed Jackrabbits on the INEL Site

Project Leader:	I. J. Ball
Student Investigator:	J. C. Grant
Cooperators:	US Department of Energy - INEL Site

Objectives:

1. Document the number of jackrabbits utilizing a radiation waste disposal site on a seasonal basis.
2. Determine daily and seasonal movement patterns of jackrabbits on and around the site.
3. Determine food habits of jackrabbits on and around the site and describe habitat components of the site that attract rabbits.

In collaboration with RESL Radioecologists:

4. Document exposure and radionuclide concentrations in jackrabbits on the site and on a control area.
5. Model radionuclide transport away from the site by jackrabbits.
6. If possible, determine forage intake rates by jackrabbits, and document the role of predators in secondary transport of radionuclides.

Results:

During the first field season, 55 jackrabbits were captured. Of these, 22 were equipped with radio transmitters, 17 were ear tagged, and 16 were sacrificed for radionuclide analysis.

Jackrabbits monitored on the study area did not move more than about 1 km daily in summer and early fall, and exibited a strong site fidelity. In November, however, an abrupt change in movement patterns was observed. All of 9 radio-equipped rabbits living near the Radioactive Waste Management Complex moved away from the site an average of 8.5 km in about 2 weeks.

Food and Habitat Selection by the Sumatran Rhinoceros in Malaysia

Project Leader:	B. W. O'Gara
Student Investigator:	R. Flynn
Cooperators:	Malaysia Department of Wildlife and National Parks, World Wildlife Fund International, National Wildlife Federation, Universtiy of Strathclyde

Objectives:

1. To determine the kinds, amounts, and chemical characteristics of foods eaten by the Sumatran Rhino (Dicerorhinus sumatrensis) in the Endau-Rompin areas of southern Peninsular Malaysia.
2. To describe the kinds of habitats used by the rhinos, especially feeding sites.
3. To gather information on the availability of foods and habitat parameters.

Results:

The thesis has been written, but has not yet been approved. An abstract will appear in the next biannual report.

Grizzly Bear Habitat Evaluation and Integration of Habitat Mapping Systems in the Bob Marshall Wilderness

Project Leader:	B. W. O'Gara
Student Investigator:	R. D. Mace
Cooperators:	US Fish and Wildlife Service, US Forest Service, Flathead National Forest

Objectives:

1. Delineate and describe grizzly bear habitat components within the study area.
2. Develop a stratified grizzly bear habitat classification system using existing systems and implementation of habitat components.
3. Develop a predictive model of grizzly bear seasonal distribution and habitat use based on food availability within the classification.
4. Generate a map of the stratified system for the study area.

Results:

The student investigator has completed the first field season and is enrolled in classes.

During the field season, the student and assistant identified and intensively sampled the vegetative communities comprising 13 habitat components. Preliminary mapping was begun, and comparisons between components and the ECOCLASS System were initiated.

Collected plant specimens were verified by Peter Stickney (USDI, Forestry Sciences Laboratory) in

October. The student is in the process of data synthesis, computer program selection, and progress report writing for the Fish and Wildlife Service.

Evaluating Elk Habitat in Terms of Cover in Central Idaho

Project Leader:	B. W. O'Gara
Student Investigator:	N. K. Lee
Cooperators:	U. S. Forest Service, Payette National Forest

Objectives:

1. Determine percentage of cover (cover index) for timber PI types (strata) on the Payette National Forest.
2. Determine amount of elk use in relation to cover and habitat type.
3. Determine elk use in relation to juxtaposition of surrounding timber stands.
4. Correlate cover index to past timber management activities.

Results:

One month of field work has been completed. Most of the work will be done June 1983 to December 1983. The thesis should be completed by June 1984.

Distribution and Habitat Utilization by Mule Deer

Project Leader:	B. W. O'Gara
Student Investigator:	S. K. Kraft
Cooperators:	The Montana Power Company, Montana Department of Fish, Wildlife and Parks

Objectives:

1. Determine distribution and habitat utilization patterns of mule deer on lands adjacent to the Carter Ferry Project.
2. Document movement patterns of mule deer, including winter and summer home ranges, activity centers, daily movement patterns and seasonal migrations.
3. Evaluate habitat quantity, quality and intensity of use.

4. Interpret biological data in reference to potential impacts of the project, contributing to the development of a comprehensive plan for mitigation.

Results:

The student investigator spent fall quarter taking classes preparing for the first winter field season. She sent out hunter questionnaries to all "B" deer tag holders in the hunting district surrounding the study area, and has had approximately 60% returned. The first winter aerial census is scheduled for late December. Deer capturing and radio-collaring operations (via helicopter drive netting) are tentatively scheduled for the first of January. Winter field work will include intensive radio tracking of collared deer, back tracking, and winter habitat evaluation. The student plans to attend classes spring quarter but will have a field assistant continue monitoring movements during this time.

Beaver Populations on Impounded and Unimpounded Rivers: Densities, Habitat Profiles, and Mitigation Strategies

Project Leader:	B. W. O'Gara
Student Investigator:	R. Bown
Cooperator:	Montana Power Company

Objectives:

1. Determine current population levels and patterns of habitat use of beavers on the Carter Ferry study area.
2. Predict the effect of anticipated water levels on the availability of potential beaver habitat after completion of the proposed Carter Ferry Dam, and identify possible mitigation measures.
3. Compare population densities of beavers on impounded and unimpounded segments of rivers in Montana.
4. Develop a "profile" of occupied beaver habitat along impounded and unimpounded segments.
5. Characterize occupied beaver habitat in impounded segments for use in planning mitigation.

Results:

A preliminary survey of the proposed Carter Ferry Dam Site was conducted in November. The student investigator is currently reviewing literature, investigating other possible study areas, and preparing for field work to begin this spring.

White-tailed Deer Winter Habitat Selection in a Second Growth Forest

Project Leader:	B. W. O'Gara
Student Investigator:	K. L. Berner
Cooperators:	Montana Forest and Conservation Experiment Station

Objectives:

1. To quantify white-tailed deer winter habitat selection in relation to forest stand age, density, canopy coverage, and stratification.
2. To determine forest structures used by white-tailed deer for various activities including feeding, bedding and travel routes.
3. Determine initial age of forest regeneration utilized by white-tailed deer.
4. Document movement patterns, including home ranges, activity centers, and daily movement patterns.

Results:

The student investigator has been taking classes fall quarter, finalizing his research proposal and preparing to begin field work in January.

Movements of Bald Eagles Associated with Autumn Concentrations in Glacier National Park

Project Leader:	B. R. McClelland
Research Associates:	H. L. Allen, J. G. Crenshaw, P. T. McClelland
Student Investigator:	L. S. Young
Cooperators:	National Park Service; Alberta Division of Fish and Wildlife; Montana Forest and Conservation Experiment Station (McIntire-Stennis funds); National Audubon Society; Wildlife Management Institute; American Petroleum Institute, USFWS, Office of Endangered Species, Bureau of Reclamation, Lower Missouri Region, Parks Canada, Colorado Division of Wildlife, Utah Div-

ision of Wildlife Resources,
Bureau of Land Management,
Echo Bay Mines, Ltd., Idaho
Department of Fish and Game,
Sigma Xi

Objectives:

1. To determine migration routes, wintering areas, and summer ranges of bald eagles associated with autumn concentrations in Glacier National Park.
2. To study local movements and ecology of this group of eagles throughout the course of seasonal movements.
3. To examine spatial and temporal relationships among bald eagles, habitats, and specific habitat components.

Results:

The student investigator is working for the U. S., Fish and Wildlife Service. His thesis is written but not yet approved. The abstract will appear in the next biannual report.

CONSERVATION, EDUCATION, AND PUBLIC RELATIONS

Bart O'Gara

2 and 7 July	Attended a Congressional Hearing in Grangeville and Boise, Idaho to explain the Northern Rocky Mountain Wolf Recovery Plan.
28 July	Attended a meeting of the Wolf Technical Committee at Whale Creek, North Fork Flathead River, and briefed the group on the outcome of Congressional Hearings in Idaho.
29 July	Conducted a NRMW Recovery Team meeting at Whale Creek.
July	Reviewed 6 & 14 pp manuscripts (with J. Ball) for J. Wildl. Manage.
20 August	Met with USFWS and USFS personnel to discuss coordination of endangered species management programs.
30 August	Appeared on a regional television newscast to explain practical aspects of managing Northern Rocky Mountain wolves using a zone system.
6 November	Spent 3 hours with Grant Creek Development Group reviewing covenants to reduce impacts on wildlife.
11 November	Lectured on predation to Student Chapter of the Wildlife Society at OSU, Stillwater, OK.
12 November	Lectured on big game research in Montana to mammalogy class at OSU, Stillwater, Oklahoma. Spent the rest of the day and evening interacting with OSU students concerning many subjects.
13 November	Gave a slide presentation on golden eagle predation to the Oklahoma Ornithological Society annual meeting in Stillwater, Oklahoma (about 110 people).
15 November	Met with new Region 6 director and ARD's in Denver concerning NRM Wolf Management Guidelines and golden eagle management/research. Also met with DWRC assistant director and several section chiefs concerning grizzly bear research proposals and golden eagle research.

30 November	Lectured for 3 hours to Montana wildlife class on Montana carnivores and predation.
November	Reviewed a 21 page chapter on predation for a text book by Dr. Jim Shaw of OSU.
8 December	Presented a U of M zoology seminar on the Soviet Union and Central Asia (about 50 faculty and students).
8 December	Shot and necropsied a deer for large mammal conservation class (about 60 students).
8 December	Spoke at the annual meeting of the Montana Rural Area Development Council in Bozeman, Montana, on wolf recovery plans.
10 December	Presented a slide show on Eurasian game management to Wildlife Forum at MSU, Bozeman, Montana.
11 December	Served as banquet speaker at Montana Guides and Outfitters banquet in Butte, Montana. Talked about predator management and wolf recovery.
15 December	Attended all-day meeting of County Rodent Control Board chairmen from Western Montana. Reported on ground squirrel/1080 research.

Joe Ball

July	Reviewed a 14 page manuscript for J. Wildl. Manage. and a 3 page manuscript for The Murrelet.
11 October	Met with biologists from Montana Power Company, USFWS - Ecological Services, and Montana Department of Fish, Wildlife and Parks. Tentative agreement was reached on mitigation for impacts of new hydroelectric retainer gates on breeding Canada geese.
18 October	Met with DOE biologists regarding jackrabbit and bobcat research.
20 October	Met with Montana Power Company biologists regarding mitigation for Canada Geese.
27 October	Met with personnel from the Confederated

	Salish and Kootenai Tribes and BIA regarding Canada Goose research in the Flathead Valley.
9 November	Met with state and federal biologists in Kalispell to discuss BPA waterfowl studies in the Flathead Valley. Numerous individual meetings and telephone conferences were held on this topic throughout the month.
17 November	Lectured for 2 hours to UM wildlife management class on wetland management.
18 November	Spoke to the Missoula Westside Lions Club on the Cooperative Unit program.
2 December	Lectured to a U of M wildlife class on careers in the FWS (about 80 students).
7 December	Spoke to U of M Student Chapter TWS on careers in FWS (about 20 students).

Phil Wright

August	Cochaired the First International Mustelid Symposium in Helsinki, Finland which was conducted as part of the Third International Theriological Congress. He also presented a paper at this symposium jointly authored with Rodney Mead of the University of Idaho in which they summarized the status of knowledge concerning reproductive cycles within the family Mustelidae.
December	Chaired the Records of North American Big Game Committee of the Boone and Crockett Club in New York City.

Dale Becker

18-21 November	Attended the Raptor Research Foundation Annual Meeting in Salt Lake City, Utah, and presented a paper entitled "Home Range and Habitat Utilization of Breeding Male Richardson's Merlins in Southeastern Montana".

Rich Harris

20 May	Lectured on computer modeling of wolf-preysystem for seminar, entitled Modeling in Applied Ecology and Resource

	Management, Mathematics Department, University of Montana.
15 July	Lectured on trapping techniques and ethics to summer class on Rocky Mountain wolves.
28-30 July	Attended Grizzly Bear and Wolf Technical Committee Meetings, Polebridge, Montana.

Jeff Holm

23 November	Lectured to freshman Wildlife Biology class on problems associated with research applications.

Don Jenni

15-19 October	Attended the annual Animal Behavior Society meeting in Duluth, Minnesota.
1 November	Attended the Conservation Fund Committee Meeting of the Campfire Conservation Club in Chappaqua, New York.

Rick Mace

July	Attended Border Grizzly Technical Meetings. Gave 2 talks; the feasibility of using spring den flights as a technique to monitor grizzly bear populations, and a brief summary of Master's project.

Jeff Marks

12 July	Reviewed an 8-page manuscript for Murrelet.
28 July	Reviewed a 4-page manuscript for Murrelet.
15 October	Reviewed a 4-page manuscript for Murrelet.
13 November	Reviewed an 8-page manuscript for Murrelet.
18-21 November	Attended the Raptor Research Foundation meeting in Salt Lake City, Utah. Presented paper: "Natal philopatry in Long-eared Owls" and poster: "A comparison of the feeding ecology of sympatric Barn Owls and Long-eared Owls" (with Carl D. Marti, Weber State College, Ogden, Utah.)

Randy Matchett

4-7 July	Spent 4 days in the Yaak River Valley with 2 high school teachers and 5 students from Lawrence, Kansas. Provided instruction and on the ground examples of many aspects of biology and forest systems. Discussions included moose ecology, forest ecology, silvicultural practices, field methods, data collection procedures, and radio-tracking. These students were on a field trip as part of an ecology class from Lawrence High School.
26 August	Presented a moose study slide show and talk to Forest Service employees and Yaak Valley residents.

PUBLICATIONS

Harris, R. and R. Ream 1982. A Method to Aid in Discrimination of Tracks from Wolves and Dogs. *in* Wolves: their status, biology and management in Canada and Alaska, (L. N. Carbyn, ed.) Canadian Wildlife Service Report No. 45.

Jenni, D. G. 1982. Sage Grouse (census techniques), pp. 66-67 *in*: Handbook of Census Methods for Terrestrial Vertebrates, ed. by D. A. Davis, CRC press, Boca Ratem. 397 pp.

Jenni, D. G. 1982. Natal Philopatry and Breeding Area Fidelity of Long-billed Curlews (*Namenius americanus*): Patterns and Evolutionary Consequences. Beh. Ecol. & Sociobiol. 10:277-279.

Marks, J. 1982. Night stalkers along the Snake. Idaho Wildlife 3:18-21.

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BIANNUAL REPORT--Dec. '81 - June '82

BIANNUAL REPORT

of the

MONTANA COOPERATIVE WILDLIFE RESEARCH UNIT

University of Montana
Missoula, Montana

to

UNIVERSITY OF MONTANA
MONTANA FISH, WILDLIFE AND PARKS COMMISSION
WILDLIFE MANAGEMENT INSTITUTE
U.S. FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR

Vol. 32, No. 2
January-June 1982

Respectfully submitted,

Bart O'Gara
Bart W. O'Gara, Leader

Joe Ball
Joe Ball, Ass't Leader

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*Terminating this Biannual

MONTANA COOPERATIVE WILDLIFE RESEARCH UNIT PERSONNEL

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W. Leslie Pengelly, University of Montana, Missoula
Bart W. O'Gara, U.S. Fish and Wildlife Service, Missoula

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Joe Ball, Assistant Leader
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John T. Harris, Forestry School
Donald A. Jenni, Zoology Department
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COOPERATING AGENCIES

University of Montana
Montana Fish, Wildlife, and Parks Department
Wildlife Management Institute
U.S. Fish and Wildlife Service

Alaska Department of Fish and Game
Alberta Fish and Wildlife Division
American Petroleum Institute
Arctic Institute of North America
Border Grizzly Project
Bowdoin National Wildlife Refuge
Bureau of Indian Affairs
Bureau of Land Management
Bureau of Reclamation, Lower Missouri Region
Charles M. Russell National Wildlife Refuge
Colorado Division of Wildlife
Confederated Salish and Kootenai Tribes
Denver Wildlife Research Center
Double Four Corporation
Echo Bay Mines Limited
Idaho Department of Fish and Game
Missoula County Rodent Control Board
Montana Department of Agriculture
Montana Forest and Conservation Experiment Station
National Audubon Society
National Bison Range
National Hispanic Scholarship Fund
National Rifle Association
National Wildlife Federation
Naval Arctic Research Laboratory
New Jersey Raptor Association
Parks Canada
Rocky Mountain Forest and Range Experiment Station
Sheldon-Hart National Wildlife Refuge
Sigma Xi
Theodore Roosevelt Memorial Fund of the American Museum
University of Wyoming
US Forest Service (Custer, Kootenai, Flathead, Targhee Forests)
US Department of Energy (INEL Site)
US National Park Service (Glacier, Yellowstone Parks)
Utah Division of Wildlife Resources
Wildlife-Wildlands Institute

PERSONNEL NOTES

Steven T. Knick joined the Unit as a Research Technician on a three-year study of bobcat ecology at the INEL Site. Steve brings to the Unit considerable expertise in research on canids and felids. He spent the month of May in Spain, instructing government biologists there on trapping and radio telemetry.

RESEARCH PROJECTS

Physiologic and Ecologic Studies of the Pronghorn (*Antilocapra americana*)

Project Leader: B. W. O'Gara

Cooperators:	National Bison Range, U.S. Fish and Wildlife Service; Yellowstone National Park, U.S. National Park Service; and the Montana Fish, Wildlife and Parks Department

Objectives:

To study:

1. the reproductive physiology of male and female pronghorn;
2. the physiology and function of scent glands;
3. food habits related to changes in range conditions;
4. horn growth and casting; and
5. the relationships of pronghorns to other artiodactyls.

Results:

Work was continued on the pronghorn book, and a paper was presented at the tenth antelope states workshop.

Population Studies of Canada Geese in the Flathead Valley

Project Leaders: J. J. Craighead and I. J. Ball

Cooperators:	USFWS, Montana Dept. Fish, Wildlife and Parks, BIA/Confederated Salish & Kootenai Tribes

Objectives:

1. To gather current data on populations, nesting areas, and nest success of Flathead geese.
2. To compare the current situation with conditions documented during 1953-60.
3. To relate changes in reproductive output of the geese to changes in habitat or management strategies since the 1950's.
4. To prepare a monograph using both historical and current data.

Results:

Availability of funds and key personnel allowed a third replicate to be completed this spring. Target date for a draft of the monograph is December 1982.

ABSTRACT

Knowles, Craig J., Ph. D., 1982 Zoology

Habitat Affinity, Populations, and Control of Black-tailed Prairie Dogs on the Charles M. Russell National Wildlife Refuge

Director: Bart W. O'Gara

Black-tailed prairie dogs (*Cynomys ludovicianus*) were studied from 1978 through 1980 on the Charles M. Russell National Wildlife Refuge, Montana; 112 prairie dog towns were found; 96 were active and occupied 0.6% (2122 ha) of the Refuge, usually on sites with less than 12% slope. Most town sites were associated with livestock watering areas and homestead sites. Roads or well-established ungulate trails were found at 109 of the towns. Horizontal visibility and bare ground were significantly greater in towns than adjacent areas; total plant and grass cover were significantly less in towns. Forb cover was greater in towns but not significantly so. Herbage utilization by prairie dogs was 29% by midsummer, and 90% by cattle and prairie dogs for the same period. Runoff appeared to be similar at a stock pond site occupied by prairie dogs and another without dogs.

From 1964 through 1979, 11 towns had a high ($r = 0.279$) initial growth rate followed by a steady decline, approaching equilibrium by 1979. Presently, growth rates are high for towns less than 10 ha (0.196) and low for towns from 10 to 100 ha and greater ($r = 0.004$ and 0.006). Snow cover and temperature in February and March appeared to influence time of breeding. *In-utero* litter size averaged 4.5 but varied significantly among years and was correlated ($r^2 = 0.88$) with precipitation from April to March prior to parturition. In a small expanding town, mortality and reproductive rates indicated a highly negative growth rate ($r = -0.434$), but increases in numbers were due largely to immigration from a nearby (3 km) large town. Dispersal occurred in all years of the study between mid-May and mid-July. Over two-thirds of the cases of dispersing dogs occurred in 1979 and were associated with a high instance (22%) of bite wounds among adults. Dispersing dogs were at least 1 year old with an even sex ratio. Of the 38 dogs observed dispersing, 37 were traveling on roads.

ABSTRACT

Leach, Rosemary H., M.S., June 1982 Wildlife Biology

Summer Range Ecology of White-tailed Deer in the Coniferous Forests of Northwestern Montana

Director: Bart W. O'Gara

During 1980 and 1981, I studied the ecology of white-tailed deer (*Odocoileus virginianus*) on the Swan-Clearwater summer range, northwestern Montana. Summer home ranges were well dispersed over the study area. Deer monitored both summers established their ranges in the same areas each year. Average home range size was 71 ha for adults and 91 ha for yearlings. Three deer followed for 24-hour periods confined movements inside or near to home ranges delineated during daytime tracking. Adult home ranges contained significantly more riparian and unlogged upland habitats, and significantly less logged upland than expected. Habitat composition within home ranges of yearlings more closely paralleled composition on the entire study area, except yearlings had significantly more logged riparian habitat than expected. Yearling ranges were composed largely of marginal (logged) habitats, most commonly logged riparian habitat with abundant deciduous cover, remnant conifers, and high diversity. Deer ranges also contained significantly more cool site and riparian habitat types and topographic features, mature subclimax coniferous forest, and diversity than expected. Adults and yearlings selected similar habitats within home ranges. Both used riparian habitats, both unlogged and logged, significantly more than expected, and upland habitats, both unlogged and logged, significantly less than expected. Management implications included: 1) protect riparian areas from logging; 2) retain unlogged coniferous forest around riparian areas; 3) plan cutting units as small (< 12 ha) and as scattered as possible (≤ 5 per section); and 4) plan additional entries only after second growth in logged units is sufficiently developed to provide hiding cover.

ABSTRACT

Zackheim, Hugh S., M.S., Spring Quarter 1982 Wildlife Biology

Ecology and Population Status of the River Otter in Southwestern Montana (100 pp.)

Director: Bart W. O'Gara

Field investigations were conducted on river otters (Lutra canadensis) in southwestern Montana from January 1980 through December 1981. Otter presence was detected by examining riverbanks for tracks and latrines, and relative otter populations were determined by scat density. Scat densities during the winter of 1980-81 were highest on the upper Jefferson and upper Madison rivers and lowest on the Ruby and upper Beaverhead rivers. Use by otters during spring and summer of 1981 was greatest on the Jefferson River near Whitehall and the Gallatin River near Three Forks; least use occurred on the Big Hole River near Melrose and the lower Madison River near Three Forks. Otters showed strong fidelity to established latrines. Latrine sites were generally in grassy openings on well-vegetated banks and averaged about 15 m^2. Scat deposition at latrines peaked from late April through mid-May.

Habitat characteristics that benefit otters include high flow volume, densely vegetated and undercut banks, and the presence of numerous sloughs and side channels that serve as brood-rearing habitat. Low flow volume and turbid water apparently reduced otter use on the Ruby and Beaverhead rivers; recent harvest may have reduced use of the lower Madison. Bank alteration through riprapping eliminates cover and denning areas and reduces otter use.

Fish occurred in 99% of the 260 scats examined. Suckers (Catastomus spp.) were the most important prey item, followed by whitefish (Prosopium williamsoni). Sculpins (Cottus bairdi) were an important sustaining food for otters, as were crayfish (Pacifasticus sp.), except in winter. Otters took the most available prey, as determined by prey abundance and accessibility.

Analysis of harvest distribution and the results of a statewide trapper questionnaire indicated densest otter populations in northwestern and southwestern Montana. Populations in these areas were seen as stable or increasing. Populations are sparse in west-central and central Montana and otters are generally absent from eastern Montana.

Hugie, Roy Dean, Ph.D., June 1982 Forestry

Black Bear Ecology and Management in the Northern Conifer-Deciduous Forests of Maine (215 pp.)

Directors: Charles Jonkel, W. Leslie Pengelly

A study concerning the ecology and management of black bears (Ursus americanus) was conducted from June 1975 through June 1980 on 2 dissimilar study areas of 370 km^2 each in northcentral Maine. The Spectacle Pond study area had less exploitation, less access, no development or human population, no agricultural lands, severer climate, and poorer soils than Stacyville. Purposes of the study were (1) determine black bear habitat and use; (2) describe movements, distributions, and habitat use in terms of human activities and land use practices; (3) determine how black bear habitat can be perpetuated; and (4) describe and compare basic biological characteristics of bears on each study area.

Bears were captured at den sites, ear-tagged, radio-collared and tracked to determine population parameters, home range size and shape, movement patterns, habitat selection, and reproductive parameters. Field observations and examination of reproductive tracts were used to determine litter sizes and ages at first breeding. The working hypothesis, that there were no differences in the parameters studied between the areas, was tested using the Chi-square statistic.

Bears on the Spectacle Pond area had a more dense population, larger home ranges, lower average litter sizes, an older age for first breeding, less annual mortality attributable to hunting, lower weights for nearly all sex and age classes, longer denning periods, and older average and median ages for females compared with bears on the Stacyville area.

Bears on both study areas preferred to use early seral stage growth adjacent to mature and intermediate forests. Reverting logging roads, raspberry areas, mature hardwood, and, in some instances, agricultural lands were important feeding areas. Important food items were grasses, legumes, and herbs in the spring; various berries and grasses in the summer; and hard mast, non-woody plants, and soft mast in the fall.

Hunting regulations should protect adult females in exploited areas. Forest practices harmful to bears included; increasing the amounts of permanent logging roads, reducing early seral growth, clear cutting hardwood, eliminating migration corridors, and large (>6 ha) cuts.

Harris, Mary A., M.S., Spring 1982 Wildlife Biology

Habitat Use Among Woodpeckers in Forest Burns (63 pp.)

Director: B. R. McClelland BRMc

Avian community composition, woodpecker foraging, and woodpecker nest-site selection were studied on commercial forest land in two coniferous forest burns near Missoula, Montana. Both burns were characterized by a concentration of woodpeckers, particularly of the genus *Picoides*. This concentration was present in response to the abundance in bark- and wood-boring beetle larvae in the fire-damaged trees. A decline in woodpeckers was observed three years post-fire. This decline coincided with the emergence of wood-boring beetles. As woodpeckers declined Mountain Bluebirds (*Sialia currucoides*) and House Wrens (*Troglodytes aedon*) increased within the burns, possibly in response to the increase in nest sites and openness. Similarity in avifaunas of the burns and adjacent unburned forests increased with vegetation regeneration.

Foraging parameters studied for the Hairy (*P. villosus*), Black-backed Three-toed (*P. arcticus*), and Northern Three-toed (*P. tridactylus*) woodpeckers included tree species, tree size, technique, and height use. The first three apparently facilitated interspecific niche partitioning and the latter intersexual partitioning. These separations were related to the distribution of trees in single-species clumps of one size class.

A strong sexual dimorphism was found for Black-backed (96%) and a less marked dimorphism for Northern (85%) Three-toed Woodpeckers. The size differences may allow niche partitioning by the sexes through acquisition of different prey. This was supported by the corresponding distributions of cerambicids with foraging locations of the woodpeckers.

The two three-toed woodpeckers nested in the smallest diameter trees, the Common Flicker (*Colaptes auratus*) in the largest, and the Hairy in the intermediate. All species used western larch (*Larix occidentalis*) in a greater proportion than was available. The two three-toed species nested in the densest stands of trees.

Management suggestions for salvage logging following fire include leaving selected western larch and as many trees of at least 34 cm dbh as possible. Leaving uncut patches within burns is also recommended.

ABSTRACT

Rabenberg, Michael J., M.S., Winter 1982 Wildlife Biology

Ecology and Population Dynamics of Mallards Wintering in the Columbia Basin (135 pp.)

Director: I. J. Ball

Winter ecology studies of mallards (Anas platyrhynchos) in the Columbia Basin were conducted from November-February 1978-79 and 1979-80. Radioed mallards remained in contact an average of 17 days with southward movements predominating. Corn comprised > 95% of the diet of both sexes after mid-November. Ungrazed stubble fields were preferred feeding sites except when snow cover forced birds to rely on cattle to expose waste grain. Mean distance to field-feeding sites was 7.9 ± 3.6 and 8.6 ± 3.6 km ($\bar{x}$ ± SD) in 1978-79 and 1979-80, respectively. Corn supplies were adequate to meet the 1979-80 mallard population requirement of 3285 metric tons. Diurnal mallard populations on concentration areas were highest 1-4 hours after sunrise. Estimates of population sex composition were 57.7-58.9% drakes in 1978-79 and 54.4-56.7% in 1979-80. Techniques for reducing bias when conducting aerial censuses or estimating sex ratios of wintering mallards are recommended. January body weights of both sexes averaged 10-14% lower than December values. Mid-winter mallard populations in the Columbia Basin were highest when water conditions in the Prairie Parklands were relatively poor, apparently a result of mallards overflying the drought-stricken prairies to breed in the Northern Pacific region. Winter weather and its effects on food availability and migration rates also appeared to influence wintering population size.

Pronghorn Antelope Behavior in Northwestern Nevada - Southeastern Oregon

Project Leader: B. W. O'Gara
Student Investigator: J. O. Meeker
Cooperators: Sheldon-Hart National Wildlife Refuge; Double Four Corporation NRA

Objectives:

1. To determine seasonal movements of pronghorns (Antilocapra americana) that summer on Hart Mountain and Sheldon Antelope Refuges.
2. To determine breeding strategies used by pronghorn with home ranges in two habitat types (Low Sage-Bunchgrass and Playa).
3. To analyze any differences noted in objective 2 above in an ecological and behavioral framework.
4. To determine trace element content of vital organs and hair of pronghorn taken at Sheldon and Hart Mountain Wildlife Refuges.
5. To establish trace element baseline data for pronghorns at Sheldon and Hart Mountain Wildlife Refuges.
6. To compare trace element data from Sheldon and Hart Mountain with hair taken from Idaho and Montana pronghorns.

Results:

Collection of movement data was terminated following a flight on 30 December 1981. At that time, only 1 transmitter was operational. To date, 169 locations have been made, 78 on summer range, 78 on winter range and 13 during migration.

During the spring quarter, 256 of 335 tissue and hair samples were prepared for analyses. All samples will be analyzed within the capabilities present at the University of Montana during the coming summer.

The student investigator attended classes during winter and spring quarters. He spent 15 May through 1 June 1982 in the study area observing male pronghorn behavior during the kidding season. For the second consecutive year, the territorial males deserted their territories during this period.

Winter Ecology of Mule Deer in the Rattlesnake Gulch Area

Project Leader: I. J. Ball
Student Investigator: R. Yeager
Cooperators: Confederated Salish and Kootenai Tribes; Bureau of Indian Affairs; National Rifle Association

Objectives:

1. Document the relative importance of various habitat types to the mule deer that winter in the Rattlesnake Gulch Area.
2. Describe movement patterns of the deer and distribution on the winter range.
3. Estimate population size and age/sex composition.

Results:

The student is currently working on data analysis and taking course work toward completion of degree requirements. Tentative date for thesis completion is December 1982.

Effects of Subdivisions and Grazing on Grant Creek Wild Ungulates

Project Leader:	B. W. O'Gara
Student Investigator:	D. Weybright
Cooperators:	Montana Department of Fish, Wildlife and Parks; National Wildlife Federation

Objectives:

1. To determine ungulate numbers, concentration areas, and migration routes on a traditional winter range prior to subdevelopment.
2. To determine forage production, utilization and range condition.
3. To document the process of subdevelopment and cattle grazing and make recommendations to minimize the negative impacts.

Results:

Elk (Cervus elaphus) returned to the winter range on Grant Creek in early December. Visual observations began in early January and ended in mid-April, 186 locations were recorded for elk. Radio locations were made throughout the period and totalled 115. Elk occurred in small bands initially and utilized heavily timbered slopes through most of the winter. The elk began to congregate by mid-March, up to 28 animals were recorded in 1 group. As snow left the south slopes they were used as well. The elk moved off the winter range by 1 June, and by 15 June, most of the elk were on summer range.

Mule deer (Odocoileus hemionus) were observed from mid-February until mid-May, 285 visual locations and 54 radio locations were recorded. The largest concentration of mule deer was 59 animals in early April as south slopes became snow-free. At present (mid-June) the mule deer are scattered between winter and summer ranges.

White-tailed deer (virginianus) are present along Grant Creek all year. Severe weather this winter made visual observations difficult as the deer seemed to use the heavy timber and not concentrate in the open areas as in previous winters. The largest group observed was only 7 animals in early April.

Trapping began in mid-February and by mid-April 34 animals were trapped. Radio collars were fitted on 6 mule deer, 3 does and 3 bucks, and on 5 elk, all cows. Second cutting alfalfa hay was used to bait modified clover traps.

Subdivision activities increased this spring as a sales office was constructed and the land surveyed on adjacent property.

Cattle grazing commenced on 7 June when 60 cow/calf pairs were placed on the winter range.

The student investigator took course work during winter and spring and plans a summer and fall field season.

Recovery of a Ground Squirrel Population Following Applications of 1080 and Effects of the Poisoning Program on Coyotes

Project Leader:	B. W. O'Gara
Student Investigator:	T. Lingel-Pate
Cooperators:	Montana Department of Agriculture, Environmental Management Division; Missoula County Rodent Control Board; Montana Department of Fish, Wildlife and Parks; US Fish and Wildlife Service, Denver Research Center

Objectives:

1. Measure the degree of ground squirrel reduction achieved by 1080 poisoning.
2. Quantify reproductive performance in treated and untreated ground squirrel populations.
3. Compare dispersal rates of young (juvenile and yearling) squirrels between treated and untreated populations.
4. Identify the source of immigrants that appear on treated areas.
5. Measure coyote population fluctuations on treated and control areas.
6. Investigate utilization of poisoned squirrel carcasses by ravens and coyotes and associated mortality.

Results:

During fall and winter quarters, the student investigator wrote a preliminary report on field work conducted during spring and summer, 1981. A rough draft was submitted to the Montana Department of Agriculture in December 1981, and the final draft was completed in February 1982. Graduate course work was completed during winter quarter 1982.

The student began the final field season in May 1982 and will work through September 1982. Tentative date for thesis completion is January 1982.

Moose-habitat Relationships in the Yaak Country, Northwestern Montana

Project Leaders:	L. Metzgar and J. Ball
Student Investigator:	R. Matchett
Cooperators:	US Forest Service, Forest and Range Experiment Station; Kootenai National Forest, and Montana Department of Fish, Wildlife and Parks

Objectives:

1. Document seasonal habitat selection by moose in representative portions of the Yaak Country.
2. Assess the impacts of logging on moose habitats, populations, and behavior.
3. Describe seasonal movement patterns of moose.
4. Develop guidelines for logging that will optimize benefits and minimize disturbance to moose.

Results:

The student investigator was in the field from 7 January until 27 March, 1982. Six moose, including 3 adult cows, 1 adult bull, 1 bull calf, and 1 female calf, were immoblized and instrumented with radio collars. Several other attempts to dart moose were unsuccessful. By the end of the field season, 71 radio locations and 49 moose sightings had been recorded. Forest Service personnel monitored moose movements during April, May, and June.

The student took courses during the spring quarter. Field work will resume in mid-June. Attempts to instrument 4 more moose, collection of relocation data, and preliminary habitat surveys will be the focus of work for the summer season. The student will be taking courses during the fall quarter of 1982.

Grizzly/Black Bear Interactions and Competition

Project Leader:	C. Jonkel
Student Investigator:	H. Carriles
Cooperators:	US Fish and Wildlife Service; Wildlife Management Institute; National Rifle Association; US National Park Service; Montana Department of Fish, Wildlife and Parks; US Forest Service; University of Montana; National Hispanic Scholarship Fund

Objectives:

1. Determine similarities and/or differences between grizzly and black bear food habits from scat analysis.
2. Compare the habitat component preferences of both species:

    a) on an individual home range basis where a grizzly and a black bear overlap, and

    b) by differences between species within the study area.

3. Evaluate grizzly and black bear food habits in the context of phenology, productivity, and nutrient content of certain important plant foods.
4. Compare the feeding strategies of both species. Identify and investigate temporal and/or spacial separation or exclusion on preferred feeding sites.

Results:

The student investigator began field work in March. Black bear dens were visited in order to mark their locations. They will be revisited in early summer to take measurements.

Attempts to drug 2 female black bears and their yearling cubs in the dens failed because of heavy snow accumulations in the study area and lack of equipment. The adults dropped their collars in May, therefore none of the yearling young were collared this spring.

Trapping was initiated to recapture specific bears. No bears suitable for collaring were captured during the spring trapping period. Limited trapping efforts will continue with efforts directed at capturing and recollaring previously collared bears and/or unmarked females.

Vegetation plots have been visited bi-weekly since late May, and the phenology of various bear plant foods were recorded. Data will be collected until leaf fall in the autumn.

Limited field work will continue this summer while the student writes his thesis.

Productivity, Nest Site Characteristics, and Food Habits of Long-eared Owls in the Snake River Birds of Prey Area

Project Leader:	B. R. McClelland
Student Investigator:	J. S. Marks
Cooperators:	Bureau of Land Management, Snake River Birds of Prey Research Project; New Jersey Raptor Association

Objectives;

1. To determine the nesting density and annual productivity of Long-eared Owls in the Birds of Prey Area.
2. To determine the influence of nest site characteristics on the nesting success of Long-eared Owls.
3. To determine the food habits of nesting Long-eared Owls.

Results:

The student investigator is currently analyzing data and writing a thesis. An abstract will appear in the next biannual report.

Reproductive Ecology and Habitat Utilization by Richardson's Merlins in Southeastern Montana

Project Leader:	I. J. Ball
Student Investigator:	D. M. Becker
Cooperators:	US Forest Service, Rocky Mountain Forest and Range Experiment Station, Custer National Forest

Objectives:

1. To locate active nests and describe habitat utilization by quantifying features of nesting and hunting habitat.
2. To determine reproductive success and possible effects of various chemical pollutants on reproduction.
3. To determine timing and duration of nesting activities.
4. To determine prey utilization.
5. To recommend management actions for Merlins and their habitat on the study areas.

Results:

Preparation of the thesis is underway; 2 of the 3 manuscripts that will constitute the thesis have been completed. Abstracts of the manuscripts will appear in the next biannual report.

The Food Habits of and Habitat Selection by a Barren Ground Grizzly Female and Cubs, Brooks Range, Alaska

Project Leader:	B. W. O'Gara
Student Investigator:	J. Hechtel
Cooperators:	Alaska Department of Fish and Game, Naval Arctic Research Laboratory, National Wildlife Federation, Wildlife Management Institute, National Audubon Society, Theodore Roosevelt Memorial Fund of the American Museum, Arctic Institute of North America

Objectives:

1. To examine in detail the seasonal food habits of a female grizzly and her two offspring, and to provide a general account of bear food habits on the western North Slope.
2. To determine daily movement and activity patterns, seasonal movements and the home range of the bears.
3. To describe and map portions of habitat within the home range of the family group.
4. To determine the seasonal habitat use patterns of the bears.
5. To conduct qualitative analysis of important bear food items.

Results:

The student investigator is working in Alaska and working on his thesis.

The Pathology and Cross-infectivity of *Sarcocystis* in mule deer, white-tailed deer, and elk

Project Leader: B. W. O'Gara
Student Investigator: D. B. Pond
Cooperator: National Bison Range

Objectives:

1. Examine the development and histopathology of *Sarcocystis* infections in mule deer.
2. Determine if *Sarcocystis* from white-tailed deer and elk can be passed through coyotes and infect mule deer.

Results:

Field and laboratory work have been completed. Results are being analyzed and an abstract will appear in the next biannual report.

Characteristics of a Hunted Mountain Lion Population (*Felis concolor*) in Western Montana

Project Leader: B. W. O'Gara and K. G. Greer
Student Investigator: K. M. Murphy
Cooperators: Montana Department of Fish, Wildlife and Parks; National Rifle Association; US Forest Service

Objectives:

1. To examine age structure, density, natality, and the distribution of mountain lions in hunted and unhunted drainages of the study area.
2. To investigate hunting pressure and harvest of mountain lions in the study area, and relate those data to population characteristics.
3. To determine timing and distance of dispersal by young animals and the age of sexual maturity in males.
4. To identify and describe winter habitat requirements of mountain lions in the study area, specifically those relating to the aquisition of prey.

Results:

The student completed his final winter field season and spring habitat work.

A total of 39 winter days were spent checking 851 miles of roads and trails for lion sign; 27 track sets were located. Lions were treed on 3 occasions: 1 female was recaptured, 1 young resident female was instrumented, and a large male, presumed a new resident, died as a result of drug-induced stress related to a widespread bacterial infection.

A marked increase in hunter pressure was noted during the 1981-82 lion kill season over previous winters due to increased snowfall and snowpack, and possible lessened aversion to the student investigator. A total of 19 different hunters spent 32 days hunting lions in the study area, engaged in 7 chases, and treed 6 adult lions, and killed 4. The adjusted hunter-induced adult mortality was estimated as 5 individuals, representing 55% of the known winter adult residents on the study area.

Two different hunters visited the study area during the chase-only season, engaged in 1 chase, and treed 1 lion.

A Study of Social Organization, Social Behavior, and Reproduction in Rocky Mountain Bighorn Sheep on the National Bison Range, Moiese, MT

Project Leader:	D. Jenni
Student Investigator:	J. Hogg
Cooperators:	Montana Fish, Wildlife and Parks Department; National Bison Range; National Rifle Association

Objectives:

1. To compile a catalog of the frequency of occurrence and the social context of selected behavioral acts, with special emphasis on behavior during rut.
2. To characterize social organization using the following parameters: groups size, group sex ratio, group age structure, dispersion of groups and individuals within groups, relative group movement.
3. To determine estrous dates, conception dates, lambing dates and lamb surviorship; and
4. To begin testing certain hypotheses regarding the effects of trophy hunting on bighorn reproduction and sociality. These data - for a non-hunted population - will be compared with similar data for the same population in a later study after trophy hunting has been simulated by removal of three-quarter or greater curl rams.

Results:

The student has submitted a first draft of his final report. The abstract will appear in the next biannual.

Ecology of the Bobcat in a Coniferous Forest Environment

Project Leader:	I. J. Ball
Student Investigator:	D. Smith
Cooperators:	Montana Department of Fish, Wildlife, and Parks

Objectives:

1. Describe overall status of western Montana bobcat populations and evaluate their structure and dynamics.
2. Characterize habitat requirements, home range, and general movements.
3. Delineate reproductive processes and relate them to the state of overall population.
4. Evaluate food preferences by stomach analyses and scats.
5. Suggest management options based on the results of this study which could improve management of bobcats.

Results:

Full-time field work was conducted from 1 January to 21 April. All field activities centered on the trapping and instrumenting of additional study animals. Nine cats, 7 bobcats and 2 lynx, were captured during this period. A male lynx, first captured in January of 1981, was recaptured and reinstrumented. Seventeen total captures were recorded for these individuals in 3,465 trap nights for a yield of 1 cat per 208 trap nights. In addition to these study animals, 3 bobcats were captured by auxiliary personnel working on a intermittent basis. This brings the total number of instrumented study animals to 15, 12 bobcats and 3 lynx. Lynx were instrumented in order to evaluate interspecific competition between the 2 species.

Sex and age structure for this sample of 15 cats is as follows: 3 juvenile female bobcats, 6 adult female bobcats, 3 adult male bobcats, 2 adult female lynx and 1 adult male lynx.

A total of 3,614 miles were traveled by snowmobile, 4X4 vehicle, and foot. Eighty seven sets of bobcat tracks were encountered (1/42 miles).

Approximately 168 aerial locations have been obtained but no analysis of these data is yet available. One radio collared bobcat was found dead, apparently from natural causes. The den of 1 adult female bobcat was located and observations are presently being made.

The student investigator is analyzing radio locations and performing habitat typing. Intensive tracking, both aerial and ground, will continue through the summer and fall.

Habitat Selection, Breeding Biology, and Density of the Mountain Plover (*Charadrius montanus*) on the Charles M. Russell National Wildlife Refuge

Project Leader:	I. J. Ball
Student Investigator:	S. Olson
Cooperators:	US Fish and Wildlife Service, Charles M. Russell National Wildlife Refuge

Objectives:

1. Determine the average nesting densities in several representative black-tailed prairie dog towns used by Mountain Plovers and determine the number and distribution of towns used by Mountain Plovers on the Refuge.
2. Determine the nesting success and productivity of these birds.
3. Quantify differences in insect densities and species distribution between prairie dog towns used by Mountain Plovers and adjacent areas.
4. Record general behavior, with special attention given to polyandrous behavior and multiple clutches within breeding pairs.

Results:

Field work is being conducted on the Western Unit of the Charles M. Russell National Wildlife Refuge. The 1982 field season is continuous from April until September. Ninety mountain plovers were banded during the 1981 field season, and 8 marked birds returned to the study area. Three were adults last year, and 5 were banded as juveniles. Fourteen additional adults were captured and banded early this season, previous to the initiation of nesting. Insect collections have been started, and plover densities and distribution on the Western Unit of the Refuge have been recorded. Courtship and breeding behavior was recorded and initial nests were located. Due to a late spring storm and unseasonably cold temperatures, first nesting attempts are believed to have failed. Currently, mountain plovers appear to be renesting, and 15 nests have been located. Plans for the remainder of the field season include location of additional nests, banding (plastic color bands and USFWS aluminum bands) and measuring adults and chicks, measuring nest site and random plot vegetation, and insect sampling. Brood survival will be determined and plover densities will be recorded throughout the season. The field season will end with the departure of the birds from the study area in late August or early September. Data analysis will begin in autumn 1982.

Habitat and Status of the Rocky Mountain Goat in the Snake River Range, Idaho

Project Leader:	B. W. O'Gara
Student Investigator:	J. A. Hayden
Cooperators:	Idaho Department of Fish and Game; US Forest Service, Targhee National Forest

Objectives:

1. Estimate the present number and age and sex composition of the goats inhabiting the Snake River Range.
2. Determine their present distribution and use of seasonal ranges.
3. Identify high-use (key-habitat) areas and describe them according to selected physical characteristics.
4. Locate nearby suitable habitat with similar characteristics to those of the high-use areas.
5. Establish permanent ground census routes to facilitate the continuation of population monitoring.
6. Develop management guidelines for the Snake River Range goat population.

Results:

After the student's initial term of coursework, the field season was begun on 24 March. Late-winter goat range was found only in the areas surrounding the original transplant sites. A helicopter survey conducted on 10 April revealed 49 goats (including 14 kids) in the Palisades Creek drainage, one of the transplant sites; 23 goats (7 kids) in the Big Elk Creek drainage, adjacent to Palisades Creek; and only 1 goat (not a kid) in the Black Canyon area, the second release site. A subsequent ground investigation of the latter area revealed 3 additional non-kids not included in the aerial survey for a minimum population of 76 goats (21 kids).

During late March and April, goats utilized southeastern exposures with cliffs from 5,600 feet (2,016 m) near the valley floor to 7,600 feet (2,736 m). Goats began dispersing from the winter ranges in early May, utilizing all but northerly aspects in elevations up to 9,600 feet (3,312 m), and lengthening their distribution linearly up the drainage.

April ground censuses in the Palisades Creek drainage yielded an average of 34.5 goats (including 12.5 kids) per survey with an average group size of 1.92. In May, ground censuses of the same area yielded an average of 22.7 goats (including 11.0 kids) per survey with an average group size of 1.83. The average group size observed during the helicopter survey was 2.58 animals in Palisades Creek and 2.56 in Big Elk Creek.

Goat fecal pellet groups were collected during April and May. An analysis of 22 pellet groups from different parts of the winter ranges was negative for lungworm (Protostrongylus rushi, P. stilesi) larvae using a modified Baermann technique. A composite sample of 25 late-winter pellets was sent to the composition lab at Colorado State University for a food habits analysis.

The remains of 3 goat carcasses were found on the winter range. An adult male was found low in the Palisades Creek drainage. This animal had been caped and is likely a poacher kill. A second adult male, six years old, was found near an avalanche chute high in the winter range and had apparently died from natural causes. An adult female was found on a partially timbered sidehill in Black Canyon by a bear hunter, also an apparent natural mortality.

A helicopter survey is scheduled for late June to help determine early-summer distribution, 1982 kid-production, and overall sex ratio. A CO_2 paint-pellet marking pistol will be used to help determine summer range and group fidelity in the Palisades Creek/Big Elk Creek area, and to detect movements into and out of the Black Canyon area. Field work is expected to continue through mid-September.

Population Dynamics and Social Systems of Exploited and Unexploited Bobcat Populations

Project Leader:	I. J. Ball
Research Technician:	S. T. Knick
Cooperators:	US Department of Energy, Idaho Fish and Game Department

Objectives:

1. Determine the effects of hunting and trapping on the social organization and population dynamics of bobcats.
2. Document kitten:female dependency period and how mortality in adult females affects subsequent vulnerability of the kittens to natural and harvest mortality. Establish distance and direction of dispersal by kittens.
3. Measure home range use by denning females and determine food requirements of raising kittens in relation to kitten survival and recruitment to the population.
4. Describe food habits in relation to prey abundance.
5. Test the validity of scent station or other population indices with a known density bobcat population.

Results:

Field work began in February, and 13 radio-marked cats are being monitored. Surveys of habitat features and prey densities are underway. A preliminary paper on social systems will be presented at a symposium in August, and an abstract will appear in the next biannual report.

Habitat Preference and Nest Success of Upland Nesting Ducks on Bowdoin NWR

Project Leader: I. J. Ball
Student Investigator: J. Holm
Cooperators: Bowdoin NWR, Montana Department FWP

Objectives:

1. Determine the number and species composition of upland nesting ducks on Bowdoin NWR.
2. Document utilization of nesting habitat.
3. Determine nest success by habitat type and major causes of nest failure.

Results:

The first field season is about half completed.

Movements, Food Habits, and Radionuclide Transport by Black-tailed Jackrabbits on the INEL Site

Project Leader: I. J. Ball
Student Investigator: J. C. Grant
Cooperators: US Department of Energy - INEL Site

Objectives:

1. Document the number of jackrabbits utilizing a radiation waste disposal site on a seasonal basis.
2. Determine daily and seasonal movement patterns of jackrabbits on and around the site.
3. Determine food habits of jackrabbits on and around the site and describe habitat components of the site that attract rabbits.

In collaboration with RESL Radioecologists:

4. Document exposure and radionuclide concentrations in jackrabbits on the site and on a control area.
5. Model radionuclide transport away from the site by jackrabbits.
6. If possible, determine forage intake rates by jackrabbits, and document the role of predators in secondary transport of radionuclides.

Results:

The student investigator arrived in June, and field work was initiated.

Food and Habitat Selection by the Sumatran Rhinoceros in Malaysia

Project Leader:	B. W. O'Gara
Student Investigator:	R. Flynn
Cooperators:	Malaysia Department of Wildlife and National Parks, World Wildlife Fund International, National Wildlife Federation, University of Strathclyde

Objectives:

1. To determine the kinds, amounts, and chemical characteristics of foods eaten by the Sumatran rhino (Dicerorhinus sumatrensis) in the Endau-Rompin areas of southern Peninsular Malaysia.
2. To describe the kinds of habitats used by the rhinos, especially feeding sites.
3. To gather information on the availability of foods and habitat parameters.

Results:

The thesis has been written, but has not yet been approved. An abstract will appear in the next biannual report.

Grizzly Bear Habitat Evaluation and Integration of Habitat Mapping Systems in the Bob Marshall Wilderness

Project Leader:	B. W. O'Gara
Student Investigator:	R. D. Mace
Cooperators:	US Fish and Wildlife Service; US Forest Service, Flathead National Forest

Objectives:

1. Develop a stratified grizzly bear habitat classification system based on verification of existing systems and implementation of habitat components. This stratified system will be evaluated within a representative section of the Bob Marshall Wilderness.
2. Delineate, describe, and map grizzly bear habitat components within the study area using existing definitions when possible.
3. Generate a composite map which integrates and verifies existing habitat classification systems.
4. Develop a predictive model of grizzly bear seasonal distribution and habitat use based on food availability and phenology of grizzly bear plant foods.

Results:

The student is in the field.

The Value of Riparian Habitats to Land Birds and the Effects of Livestock Grazing on Avian Community Structure

Project Leader: R. Hutto
Student Investigator: S. Mosconi
Field Assistants: J. Marsluff, S. Hicks, K. Turko
Cooperators: US Fish and Wildlife Service, Denver Wildlife Research Center

Objectives:

1. Compare land bird use of riparian habitats and other forest habitats in western Montana.
2. Evaluate the effects of livestock grazing on riparian vegetation and avian community structure.

Results:

The student investigator has completed field work and is analyzing data and writing her thesis. Expected completion date December 1982.

Movements of Bald Eagles Associated with Autumn Concentrations in Glacier National Park

Project Leader: B. R. McClelland
Research Associates: H. L. Allen, J. G. Crenshaw, P. T. McClelland
Student Investigator: L. S. Young
Cooperators: National Park Service; Alberta Division of Fish and Wildlife; Montana Forest and Conservation Experiment Station (McIntire-Stennis funds); National Audubon Society; Wildlife Management Institute; American Petroleum Institute; USFWS, Office of Endangered Species; Bureau of Reclamation, Lower Missouri Region; Parks Canada; Colorado Division of Wildlife; Utah Division of Wildlife Resources; Bureau of Land Management; Echo Bay Mines, Ltd.; Idaho Department of Fish and Game; Sigma Xi

Objectives:

1. To determine migration routes, wintering areas, and summer ranges of bald eagles associated with autumn concentrations in Glacier National Park.
2. To study local movements and ecology of this group of eagles throughout the course of seasonal movements.
3. To examine spatial and temporal relationships among bald eagles, habitats, and specific habitat components.

Results:

Data obtained during 1981-82 support results reported 1 year ago -- movements were similar to those observed during 1979-81. The student investigator has completed all coursework and will complete his thesis in July.

CONSERVATION, EDUCATION, AND PUBLIC RELATIONS

Bart O'Gara

4 January	Attended a meeting on Grantland and helped formulate covenants protecting wintering deer and elk. The covenants were approved and, when they were presented at a county zoning meeting, a neighboring rancher offered to donate more winter range to NWF. That possibility is being investigated.
5 January	Reviewed a 40-page manuscript for MT Dept. of Agriculture.
12 January	Spoke to the Kootenai Bird Club, Libby, MT, about eagle predation on lambs.
19-22 January	Reviewed the Northern Rocky Mountain Wolf Recovery Plan at the National Woolgrower's Convention in Portland.
26 January	Lectured on Wildlife Management in Europe to Advanced Wildlife Management (For. 475)--32 students.
28 January	Presented a lecture on predation to the U.M. Chapter of Sigma Xi
1 February	Met with personnel of the Montana Environmental Information Center and briefed them on uses of Rodenticides and predicides in Montana.
5 February	Attended Wildlife Federation Land Management meeting and agreed to prepare covenants for new platt.
16 February	Lectured to Large Mammal Management class on managing pronghorns (47 students).
23 February	Inspected a proposed platt in Grantland and worked with planners in preparing covenants to minimize wildlife impacts.
24 February	Reviewed a 4-page manuscript for Condor and a 14-page manuscript for the Northern Wild Sheep and Goat Conference.

25 February	Met with personnel of the National Resource Council and prepared a statement as leader of the Northern Rocky Mountain Wolf Recovery Team concerning impacts of gas and oil leases on wolves in the Flathead National Forest.
3 March	Lectured to U.M. Bird Management Class (20 students).
8 March	Lectured to U.M. Wildlife Management Class (50 students).
9 March	Inspected survey and fencing programs at Grantland.
11 March	Briefed U.M. President Bucklew on the Unit funding situation.
22 March	Conducted a meeting of the Northern Rocky Mountain Wolf Recovery Team.
24 March	Lectured on Predation to Wildlife Student Conclave, Corvallis, Oregon.
30 March	Presented a paper on predation at the North American Wildlife Conference.
1 April	Presented a talk on identifying predator kills to Montana FWP warden trainees in Helena.
7-10 April	Presented a paper at the 10th Antelope States Workshop in Dickinson, N.D.
15 April	Served as an outside examiner on a Ph.D. exam at the University of Alberta.
22-24 April	Testified at hearings on 1080 in Washington, D.C.
28 April	Attended a Border Grizzly Project Steering Committee meeting in Helena.
6 May	Met in Livingston, Montana, with Endangered Species personnel from Area Office to refine wolf guidelines.

10 May	Lectured to Forestry class on game ranching (70 students).
11 May	Collected an elk and a white-tailed and mule deer for biological specimens for the Rocky Mountain Veterinary Laboratory; and the Montana Fish, Wildlife, and Parks Department.
12 May	Lectured and showed movies for 6 hours to the Superior Outdoor School at Savanac Ranger Station (45 students).
13 May	Lectured to a Wildlife class on forensic science and wildlife law enforcement (45 students).
14 May	Served as moderator at a symposium held on the U of M campus by the Montana Forest and Range Experiment Station concerning research in second growth forests.
20 May	Met with personnel from the Forest Service Fire Laboratory to discuss effects of habitat manipulation on ungulate predation.
21 May	Presented six lectures on predation to outdoor school in Pattee Canyon Campground (about 75 students total).
25 May	Participated in Advisory Committee meeting for the Mission Oriented Research Program, School of Forestry, U of M.
26 May	Conducted a Wolf Recovery Team meeting in Bozeman, Montana.
During May	Reviewed and edited ADC manual (about 60 pp) for OCU, 2 papers for Mission Oriented Research Symposium (18 and 24 pp), 1 article for the Wildlife Bull. (21 pp), and a research proposal (16 pp) for a U of M zoology professor.
5-6 June	Attended annual Montana Wildlife Federation meeting in West Yellowstone and presented an introductory speech before the discussion panels.
19 June	Attended dedication of the new visitors center at the National Bison Range.

30 June	Attended Montana Fish, Wildlife and Parks Commission meeting in Billings, Montana, and presented a summary of Unit funding and activities.

Joe Ball

4 January	Attended a meeting in Bozeman to discuss an information retrieval system with CFRU Leader White and Montana FWP personnel.
8&10 February	Lectured to Fundamentals of Wildlife Management class on population management (36 students).
16 February	Lectured to Bird Management class on waterfowl management (41 students).
22-23 February	Reviewed a 4-page manuscript for Condor and a 14-page manuscript for the Northern Wild Sheep and Goat Conference.
27 March	Summarized mallard population studies at a meeting of the Pacific Flyway Technical Committee in Portland.
23 April	Met with personnel of Montana Power Co. and USFWS-Ecological Services at Thompson Falls to discuss studies of Canada geese and possible mitigation measures for hydroelectric developments.
10-11 April	Served as a judge for the International Wildlife Film Festival.
12 May	Spent the day with personnel of the Montana Power Co. and USFWS, providing advice on mitigation and management plans for Canada geese on a hydroelectric reservoir.
20 May	Participated in a meeting to assign priorities for McIntire-Stennis proposals.
During May	Reviewed 174 pp of McIntire-Stennis proposals.
1 June	Presented a program on wildlife and how a biologist works to Paxson grade school.

5-6 June	Attended annual Montana Wildlife Federation meeting in West Yellowstone, Montana.
23 June	Attended meeting of the Flathead Valley Goose Management Committee and presented a summary of the nesting study. Agreed to serve as co-author of a Flathead Valley Goose Management Plan.

Don Jenni

27-29 March	Attended 47th North American Wildlife and Natural Resources Conference, Portland, Oregon. Presented a progress report on "Bighorn Sheep Social Behavior" to the conservation committee of the Boone and Crockett Club.
23-24 April	Attended meeting of the Cooper Ornithological Society, Logan, Utah.
12-14 May	Served as annual Sigma Xi speaker at Westernly Washington University, Bellingham.

Phil Wright

1 April	Met with Grants-In-Aid Committee of the National Rifle Association, Philadelphia, to take action on research proposals. Since the meeting was reappointed to the committee for another year.
	Continued to serve as Chairman of the North American Big Game Committee of the Boone & Crockett Club and to serve on the Executive Committee.
June	Attended American Society of Mammalogists meeting, Athens, Ohio.

Len Young

January-March	Trained undergraduate students (4 hours/week) for participation in the Wildlife Bowl (The Wildlife Society, Western Students' Wildlife Conclave).

6 January	Participated in the organizational meeting of the Montana Bald Eagle Working Group (Bozeman, Montana).
3 February	Participated in the 1st general and core group meetings of the Montana Bald Eagle Working Group (Billings, Montana).
11 February	Lectured to Wildlife Techniques (WBIO 571) class on aerial radiotracking, use of telemetry to study eagle migration, and use of telemetry data-processing equipment.
18 February	Was guest speaker at weekly Sigma Xi meeting: "Movements of Bald Eagles Associated with Autumn Concentrations in Glacier National Park."
25 February	Lectured to Bird Conservation and Management (FOR 473) class on conservation and management of marine birds.
8-9 March	Attended conference on "Women in Natural Resources: An International Perspective" (Moscow, Idaho).
22-26 March	Traveled to Oregon State University (Corvallis, Oregon) with University of Montana Wildlife Bowl team, as team advisor, where the team participated in the 18th Annual Western Students' Wildlife Conclave (The Wildlife Society).
27 March	Attended Pacific States Bald Eagle Recovery Team meeting (Portland, Oregon).
27-31 March	Attended the 47th North American Wildlife and Natural Resources Conference (Portland, Oregon).
6 April	Met with the author of a book for children on bald eagles, discussed eagle ecology and management, and demonstrated research equipment.
14-17 April	Attended Northwest Section of The Wildlife Society annual meeting (Juneau, Alaska), presented paper: "Movements of Bald Eagles Associated with Autumn Concentrations in Glacier National Park: A Preliminary Report."

23 April	Reviewed manuscript of a book for children on bald eagles.
14 May	Attended University of Montana School of Forestry Mission-Oriented Research Program (MORP) symposium on management of 2nd-growth forests in the northern Rocky Mountains.
9 June	Attended seminar on "Men and Women on the Job: Sex Roles and Lifestyles in the 1980's" sponsored by the US Forest Service (Missoula, Montana).

Harry Carriles

3-5 February	Attended Montana Chapter of TWS meeting in Billings, Montana.
24 February	Presented talks on bear research to 2 5th grade classes in Missoula.
2-4 March	Presented a research progress report at the Western Black Bear Workshop in Logan, Utah.
18 March	Displayed research equipment and discussed techniques at Girl Scout Council in Missoula.
19 May	Presented research progress report at a NPS bear management meeting in West Glacier, Montana.

Jeff Marks

16 April	Served as judge at the Montana Science Fair.
22-25 April	Attended the Cooper Ornithological Society meeting in Logan, Utah. Presented a paper on prey selection by long-eared owls.

Rosemary Leach

29-31 March	Attended 47th North American Wildlife and Natural Resources Conference, Portland, Oregon.

16 April	Served as a judge at the Montana Science Fair.
28 May	Led a 6th grade class at Darby School on a wildlife field trip.

Randy Matchett

17 February	Presented a slide show on the moose habitat study to Forest Service personnel and residents of the Yaak River Valley.

Darrel Weybright

26-31 March	Attended the 47th North American Wildlife and Natural Resources Conference in Portland, Oregon.

Jo Meeker

7-10 April	Attended 10th Pronghorn Antelope Workshop, Dickinson, North Dakota.

PUBLICATIONS

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Knowles, C.J. and R.B. Campbell. 1982. Distribution of elk and cattle in a rest-rotation grazing system. pp. 47-60 *in* Peek, M. and P.D. Dalke. Wildlife-Livestock Relationships Symposium: Proc. 10. University of Idaho, Forest, Wildlife and Range Experiment Station, Moscow, Idaho.

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McNay, M.E. and B.W. O'Gara. 1982. Cattle-pronghorn interactions during the fawning season in northwestern Nevada. pp. 593-607 in Peek, M. and P.D. Dalke. Wildlife-Livestock Relationships Symposium: Proc. 10. University of Idaho, Forest, Wildlife and Range Experiment Station, Moscow, Idaho.

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BIANNUAL REPORT--July-Dec. 1981

BIANNUAL REPORT

of the

MONTANA COOPERATIVE WILDLIFE RESEARCH UNIT

University of Montana
Missoula, Montana

to

UNIVERSITY OF MONTANA
MONTANA FISH, WILDLIFE AND PARKS COMMISSION
WILDLIFE MANAGEMENT INSTITUTE
U.S. FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR

Vol. 32, No. 1
July-December 1981

Respectfully submitted,

Bart W. O'Gara
Bart W. O'Gara, Leader

Joe Ball
Joe Ball, Ass't Leader

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MONTANA COOPERATIVE WILDLIFE RESEARCH UNIT PERSONNEL

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W. Leslie Pengelly, University of Montana, Missoula
Bart W. O'Gara, U.S. Fish and Wildlife Service, Missoula

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Joe Ball, Assistant Leader
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Donald A. Jenni, Zoology Department
Charles Jonkel, Forestry School and Montana Fish, Wildlife and Parks Department
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COOPERATING AGENCIES

University of Montana
Montana Fish, Wildlife, and Parks Department
Wildlife Management Institute
U.S. Fish and Wildlife Service

Alaska Department of Fish and Game
American Petroleum Institute
Arctic Institute of North America
Border Grizzly Project
Bureau of Indian Affairs
Bureau of Land Management
Champion International
Chapman Foundation
Charles M. Russell National Wildlife Range
Confederated Salish and Kootenai Tribe
Custer National Forest
Denver Wildlife Research Center
Flathead National Forest
Harriman State Park
Idaho Department of Fish and Game
Idaho National Engineering Laboratory
Kootenai National Forest
Maine Department of Inland Fisheries and Wildlife
Malaysia Department of Wildlife and National Parks
McInntire Stennis
Missoula County Rodent Board
Montana Departments of Agriculture and Livestock
Montana Fish, Wildlife and Parks Department (Bozeman Laboratory)
National Audubon Society
National Bison Range
National Rifle Association
National Wildlife Federation
Naval Arctic Research Laboratory, University of Alaska
Nevada Department of Fish and Game
Nevada Department of Wildlife
New Jersey Raptor Association
Penobscot Valley Conservation Association
Rocky Mountain Forest and Range Experiment Station
Sheldon-Hart National Wildlife Refuge
Sigma Xi
Smithsonian Institute
Targhee National Forest
Theodore Roosevelt Memorial Fund of the American Museum
USDA Forest Service, Boise District
USDA Forest Service, Forestry Sciences Laboratory
US Department of Energy
US National Park Service
US Peace Corps, Malaysia

University of Maine
University of Montana, School of Forestry
Wildlife-Wildlands Institute
World Wildlife Fund International
Yellowstone National Park

PERSONNEL NOTES

Many changes have been made in our YACC personnel. Susuan Kraft finished her year on 31 October and is currently working at Taxidermy Unlimited. Brian Giddings finished his year on 4 December. He is working with Drew Smith on his bobcat project as a volunteer. Sheryl Jackson finished her year on 11 December. She is now working at a temporary job in Research Administration over in the Main Hall of the campus. We have several new additions to our YACC ranks. Kendra Sater joined us in August. She graduated from Big Sky High School in June, where she majored in Business. Randy Matchett came along in September and he will be working on the Moose project up in the Yakk country. Nancy Halstead joined us in November. She will be working in Idaho on the Bobcat project. Rick Levesque is still with us and will be working with Randy on the Moose project. We have two work study students this year, John Murnane, who isn't a new face and Sandy Rubrecht. John was with us 2 years ago as a work study. Sandy was employed by the Fish and Wildlife Service for 9 years, before she decided to go back to school to finish her education. They are both welcome additions to our crew.

RESEARCH PROJECTS

Physiologic and Ecologic Studies of the Pronghorn (*Antilocapra americana*)

Project Leader: B. W. O'Gara
National Bison Range, U.S. Fish and Wildlife Service; Yellowstone National Park, U.S. National Park Service; and the Montana Fish, Wildlife and Parks Department

Objectives:

To study:

1. the reproductive physiology of male and female pronghorn;
2. the physiology and function of scent glands;
3. food habits related to changes in range conditions;
4. horn growth and casting; and
5. the relationships of pronghorns to other artiodactyls.

Results:

Work was continued on the pronghorn book.

Population Studies of Canada Geese in the Flathead Valley

Project Leaders: J.J. Craighead and I.J. Ball

Objectives:

1. To gather current data on populations, nesting areas, and nest success of Flathead geese.
2. To compare the current situation with conditions documented during 1953-60.
3. To relate changes in reproductive output of the geese to changes in habitat or management strategies since the 1950's.
4. To prepare a monograph using both historical and current data.

Results:

The final field season was completed and the results are being analyzed. Anticipated date of monograph completion is December 1982.

ABSTRACT

Albert, Steven W., M.S., 1981 Wildlife Biology

Morphological Variation in Bobcats of Northwestern America

Directors: I.J. Ball and C.J. Jonkel

Morphological variation of bobcat (*Felis rufus*) populations from British Columbia, Washington, Oregon, Idaho, and Montana was studied using 14 cranial, 6 mandibular, and 15 dental measurements. Univariate and multivariate methods of analysis were used to assess geographic variation in 416 adults (279 males and 137 females) pooled into 26 geographically contiguous localities. Coastal (*Felis rufus fasciatus*) and interior (*F. r. pallescens*) forms were divided sharply by the Cascade crest in Washington and B.C., but less so in Oregon. With respect to inherent intralocality variation, males of both subspecies showed greater variability than females. Interlocality variation in coastal females was greater than in coastal males, but slightly less than in males from the interior. Width dimensions were more variable than length dimensions for both sexes in both subspecies. *F. r. pallescens* displayed greater variation among and within sample localities. Of 35 characters, 34 exhibited significant sexual dimorphism with males larger than females. The intensity of dimorphism was greatest among the mandibular characters. *F. r. pallescens* was significantly less dimorphic than *F. r. fasciatus*. Coronoid height, diastema length, and depth of jaw showed the greatest relative differences between sexes. Discriminant functions were computed to identify unsexed individuals. Twenty-five male and 26 female characters showed significant interlocality variation with 7 dental characters showing no variation for both sexes. Localities were projected onto 3 principal components based on character correlations. Component I (a size factor) showed that for both sexes the largest bobcats occur in southern Idaho. The smallest males were found in eastern Montana, and the smallest females in western Oregon. Component II described the jaw and tooth shape gradient. Bobcats with relatively robust dentition and thick jaws occurred in western Washington, with the opposite true for individuals from southwestern Idaho. Phenograms were derived and substantiated these relationships. Rivers seemed to act as barriers to gene flow and to enhance the degree of differentiation of populations. Character usefulness, reliability, and redundancy were evaluated and a reduced character suite was recommended.

ABSTRACT

Sherwood, Harrie W., M.S., Fall 1981 Wildlife Biology

Morphological Variation of Grizzly Bear Skulls from Yellowstone National Park (

Director: Philip L. Wright

Cranial characters of tooth eruption of the permanent dentition tooth wear, cranial sutures, and 24 cranial measurements were examined on 67 (43 males, 24 females) grizzly bear (*Ursus arctos horribilis*) skulls from Yellowstone National Park to investigate the cranial variations of grizzlies with respect to age, sexual, and individual variation and to examine the utility of using cranial characters of indicators of age and sex. Twenty four of the bear skulls were of known age whose ages ranged from cubs to 11 years old. The eruption of the grizzly bear dentition began sometime before the fifth month of life and was completed by the seventeenth month, except for the canines and M_3 which were erupted by the third year of life. Tooth wear increased with age but was poorly correlated with age due to considerable variation between individual bears of the same age class. The sequence of cranial suture closure occurred at approximately the same age for all grizzlies.

For taxonomic and statistical purposes of skull size, bear skulls were classified into six age classes on the basis of tooth eruption and wear, bone fusion, changes in cranial structure, and chronological age. Female grizzly skulls attained adult size earlier and were significantly smaller than adult male grizzly skulls. Maximum female cranial size was reached between the ages of 6 to 11 years. Male grizzlies did not grow appreciably in length beyond 12 years of age, but continued to grow in breadth and height beyond 12 years of age. Age estimation by multiple regression, discriminant analysis, and cranial sutures gave reliable results.

As age increased there was an increased difference in cranial size between male and female grizzlies. Skulls of adult male grizzlies averaged 13 percent larger than adult female skulls. Sex-related differences in size of the sagittal crest, mastoid breadth, zygomatic breadth, as well as discriminant analysis were useful in determining the sex of unknown adult grizzly skulls. Young bears of the same age-sex class were more variable in skull size than adult bears of the same age-sex class. Individual differences in the presence or absence of the anterior premolars was of little taxonomic consequence.

ABSTRACT

Knowles, P. R., M.S., December 1981 Wildlife Biology

Habitat Selection, Home Range Size, and Movements of Bobcats in North-Central Montana (52 pp.)

Director: Bart W. O'Gara

A study of bobcat habitat selection and movements was conducted from January 1979 through August 1980 on the Charles M. Russell National Wildlife Refuge in north-central Montana. Five cats (1 adult female, 1 adult male, 2 juvenile males, and 1 juvenile female) were radio-collared and followed from 2 weeks to 17 months with 3 of the cats accounting for 429 of the 457 relocations. Home range size was largest (83.3 km^2) for the adult male, followed by the adult female with 17.8 km^2 and her male kitten with 5.8 km^2. The 2 remaining juveniles had too few relocations to accurately reflect home range size. Both juvenile males were illegally killed within 2 months after marking and the fate of the juvenile female remained undetermined at the end of the study. Nine cover types were designated on the study area and vertical vegetative cover was measured with a coverboard for each type. The juniper cover type was the densest (93% cover), followed by river bottom (75%), Douglas-fir (71%), dense pine (52%), greasewood (30%), open pine (24%), sage-grass (11%), agricultural (9%), and prairie dog town (3%). The 3 cats with over 50 relocations all showed significant selection for cover types with 52% cover or greater. The only cover type with less than 52% cover used more often than expected was that of prairie dog towns. Lagomorph pellet transects showed a high positive correlation with cover type density. The highest densities of small rodents were in the dense cover types (greater than 50% cover) and the sage-grass cover type.

Hampton, Paul D., M.S., Fall 1981 Wildlife Biology

The Wintering and Nesting Behavior of the Trumpeter Swan (185 pp.)

Director: Richard Hutto RLH

The wintering and nesting behavior of the Trumpeter Swan was investigated from October 1979 to July 1981 within parts of Yellowstone National Park and the Targhee National Forest to access the cause of the relatively low productivity of the Tri-state Trumpeter population.

During the summer of 1979, the Idaho Department of Fish and Game drained Island Park Reservoir and poisoned it with rotenone. Although the poison did not affect the swan's wintering area, decreased discharge in the river resulted in widespread freezing and changes in both macrophyte and invertebrate populations.

Wintering Trumpeters utilized a habitat that consisted of slow moving water with large amounts of aquatic vascular plants. Cover requirements consisted of areas away from human activity and large obstructions. The most commonly observed behavior during the winter was feeding. This was also the activity that demanded the most energy. Levels of resting varied inversely with the amount of feeding. All other behaviors were performed at a nearly constant daily level.

Food preferences appeared to be dictated by site preference. As previous studies have shown, Trumpeters were primarily vegetarians. However, as much as ten percent of the protein they consumed originated in animal material, primarily invertebrates and fish.

Nesting behavior was characterized by long and frequent recesses, resulting in only 75 to 80 percent of the day being spent on the nest. Despite this, nest temperature was high and fairly constant.

The recent reproductive failure of Trumpeters in the Tri-state Region as recognized by Shea (1978) and Page (1976) continued through the duration of the study. The explanation for this appears to be that the swans cannot consume enough nutrition to meet their dietary requirements. By breeding season, the adults appeared to be in such poor condition that the eggs were not nutritionally viable.

Two management solutions are proposed: A Mute Swan-Trumpeter Swan Cross-Fostering Program; and a translocation of wintering swans. Active management should be undertaken in the near future to insure the continued existence of the Yellowstone population.

Conry, Paul J., M.S., Fall 1981 Wildlife Biology

Habitat Selection and Use, Movements, and Home Range of Malayan Gaur (*Bos gaurus hubbacki*) in Central Pahang, Malaysia. (120 pp.)

Director: Bart W. O'Gara

The ecology of the Malayan gaur in the rapidly developing Lepar River Valley was investigated from September 1977 to May 1979. An adult bull, yearling female, and yearling male were radio-collared and their movements and habitat use monitored. The population was estimated at 62 animals in 7 herds during July 1978 track surveys. The adult:calf ratio was 100:24. Groups sizes ranged from 1 to 15 with a mean of 5.0. Aggregates of 2-5 and 6-10 accounted for 35 and 34% of observations, lone animals 23%, and groups larger than 10, 8%. Calves were born throughout the year. One instance of poaching of a juvenile gaur was detected. Parasites found in and on gaur were *Seteria* sp.; *Eimeria* sp. oocysts; ova of *Fasciola hepatica*, *F. gigantica*, and unidentified nematodes; and *Apponomma* sp. and *Boophilus microphilus* ticks. The home range of the adult bull was 7018 ha, the female 5218 ha, and the yearling male 2989 ha. Home range size and configuration was strongly influenced by physiographical features. Mean daily movements for the 3 animals were 1505, 1218, and 663 m. The more important habitat use patterns of the gaur were heavy use of the man-modified habitats of secondary forests and agricultural estates, and lowland riverine areas. The adult bull and female selected against areas within 500 m of major roads and zones of very high disturbance, but the yearling male selected for both categories. A direct relationship between the creation of favorable foraging conditions and levels of disturbance was detected. Agricultural development fragmented the population into 2 groups on opposite sides of the River Valley. Feeding site examinations identified 87 species in the diet. *Paspalum conjugatum*, *Mikania chordata*, and *Centrosema pubescens* were important food items. Nutrient quality of forage was at or slightly above maintenance requirements, but may be lacking in crude protein and phosphorus for optimum reproduction and growth of calves. Population fragmentation, low calf recruitment, human disturbance, and habitat loss to agricultural development were identified as conservation problems. Management recommendations include: create wildlife reserves; improve gaur habitat; increase law enforcement activities; plan logging operations to benefit gaur; locate roads away from gaur use areas; close roads following logging; and leave forested corridors between separated subpopulations.

ABSTRACT

Connelly, John W., Jr. Ph.D. 1982 Zoology

An Ecological Study of Sage Grouse in Southeastern Idaho

Director: I.J. Ball IJB

This study was conducted between June 1977 and April 1981 on the United States Department of Energy's Idaho National Engineering Laboratory (INEL) site in southeastern Idaho. The INEL site is a 231,600 ha area dominated by sagebrush (*Artemisia* spp.) and various bunchgrasses.

The first section of this dissertation describes the movements and radionuclide concentrations of sage grouse (*Centrocercus urophasianus*) summering near 3 INEL facilities; the Test Reactor Area/Idaho Chemical Processing Plant (TRA/ICPP) complex, the Radioactive Waste Management Complex (RWMC), and the Central Facilities Area (CFA). The potential dose commitment to a person consuming a grouse that summered near these facilities is also discussed.

Sage grouse used lawns surrounding INEL facilities for feeding and loafing throughout the summer. These birds were captured and marked to provide information on home range and movements. From July through September, 95% of all radio-locations were within 2 km of INEL facilities. During October and November, 82% of all radio-locations were greater than 2 km from these areas. Mean summer home range was 406 ha for adult female sage grouse and 94 ha for juveniles.

Radionuclide concentrations in TRA/ICPP grouse were significantly higher than those of RWMC or control birds. Sage grouse acted as transport mechanisms and remove radionuclides from waste storage systems, but the quantities removed per individual were small and apparently constituted no hazard to the bird or to a person consuming the bird. The highest estimated potential dose commitment to a person consuming a grouse from TRA/ICPP, RWMC, or control areas was 2.37 mrem, and would have resulted from eating an adult male sage grouse that had summered near TRA/ICPP.

Sage grouse remained in segregated flocks during early summer, but the number of mixed sex flocks increased in late summer. Mixed sex flocks were significantly larger than male, female, or female/juvenile flocks. Sage grouse occurred in segregated flocks throughout the winter. Mean flock size was significantly different among all flock types. Further, male and mixed sex flocks were significantly larger in low sagebrush (*A. arbuscula*) than in big sagebrush (*A. tridentata*) habitats. Sage grouse responded to increasing snow depths by moving into denser and taller sagebrush stands. Mean flock size remained relatively constant as winter weather became more severe.

Agricultural areas were an important component of sage grouse summer range on and near the INEL site. This habitat was preferred by all sage grouse sex and age classes. During winter, differences were detected in habitat use by males, females, and grouse occurring in mixed sex flocks. Sage grouse winter range was generally characterized by sagebrush stands with 11 to 30% canopy coverage and a mean height of less than 40 cm.

Burnett, Gary W., M.S., Fall 1981 Wildlife Biology

Movements and Habitat Use of American Marten in Glacier National Park, Montana (130 pp.)

Director: B. R. McClelland

Movements of American marten (Martes americana) in Glacier National Park, Montana were studied from March 1979 to September 1980 by radio telemetry. Radio collars were fitted on 6 juveniles (4 male, 2 female) and 5 adults (3 male, 2 female). Collared marten were located 142 times, primarily by ground tracking. All collared adult marten were resident on the core study area, while 2 juvenile males established resident home ranges and 2 were non-resident. Collared juvenile females were non-resident. Home range ellipses of adult marten showed little intrasexual overlap, but extensive intersexual overlap. Adult males and adult females occupied average home ranges of 2.9 sq km and 0.7 sq km, respectively. Resident juvenile males had home ranges averaging 0.7 sq km. Non-resident marten occupied areas significantly larger than the average area residents occupied.

Marten moved an average of 0.6 km (range 0.1 to 2.8 km) between consecutive days. Non-residents traveled significantly farther (mean=4.1 km) than residents (mean=0.8 km) between initial collaring site and relocations.

Adult marten occupied a variety of cover types but locations where concentrated in mesic spruce types. Abies lasiocarpa/ Clintonia uniflora and Picea/Clintonia uniflora habitat types were most heavily used. Juvenile marten also used a variety of cover types but locations were not concentrated in any one type. All marten showed a preference for canopy cover greater than 17%.

Daytime resting sites (N=36) were located significantly more often in trees than on the ground. Cover and habitat types were not significantly different between sheltered and unsheltered resting sites.

Management measures that will favor marten populations should emphasize the perpetuation of forest mosaics with old-growth components. This can be accomplished on reserved lands (e.g., national parks, wilderness areas) by accepting and reinstating the role of fire and other natural processes. On commercial lands the goal can be accomplished by careful planning of harvest areas and selection of silvicultural systems. The marten habitat quality of potential harvest sites can be determined based on guidelines provided.

Habitat Selection, Populations, and Control of Black-Tailed Prairie Dogs (*Cynomys ludovicianus*) on the Charles M. Russell National Wildlife Refuge

Project Leader:	B.W. O'Gara
Student Investigator:	C. Knowles
Cooperators:	U.S. Fish and Wildlife Service, Charles M. Russell National Wildlife Refuge

Objectives:

1. Determine distribution, size and status of all prairie dogs towns within the Wildlife Refuge.
2. Determine habitat selection by prairie dogs within the Wildlife Refuge.
3. Determine population dynamics of prairie dogs and identify environmental factors which may influence numbers of prairie dogs within and between years within a prairie dog town.
4. Investigate the dynamics of colonization by prairie dogs of the Wildlife Refuge.
5. Evaluate and compare the effectiveness of 3 possible methods of control--poisoning, shooting, and habitat alteration.
6. Investigate the association and relationship of prairie dogs to areas of intensive livestock use and/or areas of human disturbance.

Results:

The student investigator has completed his field work and is in the process of completing his dissertation. A brief summary of the results follows:

A study considering habitat factors, population dynamics, and control techniques of black-tailed prairie dogs (*Cynomys ludovicianus*) was conducted from 1978 through 1980 on the Charles M. Russell National Wildlife Refuge in Montana. A total of 112 prairie dog town sites was found of which 96 were active and occupied 0.6% (2122 ha) of the Refuge. The majority of the town sites were associated with livestock watering areas and old homestead sites. Roads or well established cattle (*Bos taurus*) trails were found at 109 of the 112 town sites. Prairie dog towns usually occupied sites with less than 12% slope. Almost all towns were found in shrub-grassland and grassland habitats of which the *Artemisia tridentata*-*Bouteloua gracilis* habitat type was the most frequently occupied. Horizontal visibility and bare ground were significantly greater in towns than adjacent areas; while total plant cover and grass cover were significantly less in towns. Forb cover was greater in towns but not significantly so. Vegetative standing crop within an active section of a dog town was 15% greater than an inactive section. This was due to increased production of forbs in the active area. Vegetative utilization by prairie dogs averaged 29% by early August. Utilization by cattle and prairie dogs averaged 90% for the same time period. Water run-off appeared to be similar at a stock pond site occupied by prairie dogs and another site not

occupied by dogs. Growth records for 11 towns on the Refuge from 1964 to 1979 showed a high ($r = 0.29$) initial rate of growth followed by a steady decline in growth rate and approaching equilibrium by 1979. From 1974 to 1979 the intrinsic rate of growth was highest ($r = 0.19$) for towns less than 10 ha and equally low ($r = 0.004$ and 0.006) for towns from 10 to 100 ha and greater than 100 ha. Prairie dog towns exhibited density dependent growth and closely approximated a logistic type growth pattern. Estimated carrying capacity of the Refuge under present conditions is 2966 ha. Mean conception dates for prairie dogs varied significantly between years (28 March to 12 April). Snow cover and temperature in February and March appeared to greatly influence time of breeding. In-utero litter size averaged 4.5 but varied significantly between years and was correlated ($r^2 = 0.88$) with precipitation from April to March prior to parturition. Trapping and marking of prairie dogs at a town stable in size since 1964 revealed substantial changes in densities of dogs in relation to forage production but only minor changes in total numbers. Re-occupation of abandoned sections of the town during dry years resulted in the density declining from 30.6 dogs/ha to 19.6 dogs/ha. In a small, expanding town, mortality and reproductive rates indicated a highly negative growth rate ($r = -0.4338$) but increases in numbers were due largely to immigration of prairie dogs from a nearby (3 km) larger town. Dispersal of prairie dogs occurred in all years of the study between mid-May and mid-July. Over 2/3 of the cases of dispersing dogs occurred in 1979 and was associated with a high instance (22%) of bite wounds among adult dogs in towns. All dispersing dogs were at least 1 year old and did not differ significantly from a 1:1 sex ratio. Of the 38 dogs actually observed to be dispersing, 37 were traveling on roads. Dispersing dogs were observed to dig burrows in intensively grazed sites and areas of soil disturbance. Yearling males showed considerable movement within 1 town while yearling females showed high levels of fidelity to natal coteries. Coteries in this town were stable within and between years. The coterie social system resulted in a clumped dispersion pattern for marked dogs. Application of 2% zinc phosphide treated oats in 4 treatment patterns in 7 towns resulted in an average of 88% reduction of prairie dogs in the treated areas. Relative to reached controls, pre-treatment populations were obtained within 2 years for towns receiving perimeter and split reduction treatments. Another 2 years appeared to be needed to obtain pre-treatment populations in towns receiving total reduction treatment. The center reduction treatment produced intermediate results. Removal of 17 dogs/ha was accomplished by shooting in early summer 1978 at 5.9 and 1.4 ha towns, populations declined 37 and 50%. Shooting a second successive year supressed the populations even further, but both towns showed strong recovery trends the third year in the absence of shooting. Placement of predator hiding obstacles in a 2 ha area of a 24.6 ha town resulted in supressed prairie dog activity levels during both years of the experiment. However, apparent immigration into the treated area in late spring of each year equalized activity levels between the treated and control areas.

Pronghorn Antelope Behavior in Northwestern Nevada - Southeastern Oregon

Project Leader:	B.W. O'Gara
Student Investigator:	J.O. Meeker
Cooperators:	U.S. Fish and Wildlife Service, NRA

Objectives:

1. To determine seasonal movements of pronghorns (Antilocapra americana) that summer on Hart Mountain and Sheldon Antelope Refuges.
2. To determine breeding strategies used by pronghorn with home ranges in two habitat types (Low Sage-Bunchgrass and Playa).
3. To analyze any differences noted in objective 2 above in an ecological and behavioral framework.
4. To determine trace element content of vital organs and hair of pronghorn taken at Sheldon and Hart Mountain Wildife Refuges.
5. To establish trace element baseline data for pronghorns at Sheldon and Hart Mountain Wildlife Refuges.
6. To compare trace element data from Sheldon and Hart Mountain with hair taken from Idaho and Montana pronghorns.

Results:

Tissue and hair samples were collected during the hunting season at Hart Mountain and Sheldon. Trace element analysis is scheduled to be accomplished during the next four months.

One radio-collared buck was killed by a hunter at Hart Mountain in August. Observation of radio-collared animals in August and September indicate that additional radios may be broadcasting intermittently or failing.

Data on breeding behavior were collected during the rut period at Sheldon. Indications are that territorial males maintain their territories but readily leave their territories in order to gain possession of females that are then herded back to the male's territory.

The student investigator is presently attending classes. The first location flight for this winter is scheduled for 29 December 1981.

Food and Habitat Selection by the Sumatran Rhinoceros in Malaysia

Project Leader:	B.W. O'Gara
Student Investigator:	R. Flynn
Cooperators:	Malaysia Department of Wildlife and National Parks, World Wildlife Fund International, National Wildlife Federation, University of Strathclyde

Objectives:

1. To determine the kinds, amounts, and chemical characteristics of foods eaten by the Sumatran rhino (Dicerorhinus sumatrensis) in the Endau-Rompin ares of southen Peninsular Malaysia.
2. To describe the kinds of habitats used by the rhinos, especially feeding sites.
3. To gather information on the availability of foods and habitat parameters.

Results:

The student investigator completed field work in August and returned to the University to analyze data.

Winter Ecology of Mule Deer in the Rattlesnake Gulch Area

Project Leader:	I.J. Ball
Student Investigator:	R. Yeager
Cooperators:	Confederated Salish and Kootenai Tribes; Bureau of Indian Affairs; National Rifle Association

Objectives:

1. Document the relative importance of various habitat types to the mule deer that winter in the Rattlesnake Gulch Area.
2. Describe movement patterns of the deer and distribution on the winter range.
3. Estimate population size and age/sex composition.

Results:

Field work was completed at the end of March. The student is currently working on data analysis and taking course work toward completion of degree requirements. Tentative date for thesis completion is June 1982.

Effects of Subdivisions and Grazing on Grant Creek Wild Ungulates

Project Leader:	B.W. O'Gara
Student Investigator:	D. Weybright
Cooperators:	Montana Department of Fish, Wildlife and Parks; National Wildlife Federation

Objectives:

1. To determine ungulate numbers, concentration areas, and migration routes on a traditional winter range prior to subdevelopment.

2. To determine forage production, utilization and range condition.
3. To document the process of subdevelopment and cattle grazing and make recommendations to minimize the negative impacts.

Results:

Emphasis this summer and fall has been on monitoring radio-marked elk and deer, pellet group counts, mapping vegetation communities, and determining forage production and utilization by cattle grazing on the Grantland Nature and Wildife Reserve.

The elk and deer have spent the summer and much of the fall on summer range. Radio-locations have totaled 281 for six elk and 15 for one mule deer. One bull was taken by a hunter, another, also a bull, broke radio contact in late July. The remaining 4 elk and 1 mule deer are scattered at this date.

A fall pellet group count had results similar to last year's count for elk, 1778 elk days for winter 1981 as compared to 1644 elk days for winter 1980. The result for deer was nearly 5 times the previous year, 3556 deer days as compared with 759 deer days previously. White-tailed deer use this range all year and concentrate with the elk and mule deer during mid-winter.

Patterns of elk and deer use based on pellet groups have been mapped and tabulated by vegetative community, aspect and position on it's slope.

Also mapped were 32 vegetative communities, four habitat types, and seven soil series. Forage production was estimated from 640 4.8 ft^2 plots and results were recorded in pounds per acre, by species, and by vegetative community. Dominate forage species were grasses: Agropyron spicatum, Festuca idahoensis, F. scabrella, and Poa pratensis; forbs: Balsomorhiza sagittata, Lupinus spp., and Centaurea maculosa; and shrubs: Physocarpus malvaceus and Symphoricarpos albus. Production estimates varied widely because of topographic features, life form of the plant species and impacts of herbivores.

Cattle grazing commensed on 20 May and terminated 25 August. Approximately 180 cow/calf pairs were grazed on pastures common to adjacent landowners. After the cattle were removed, 440 4.8 ft^2 plots were used to determine amount of forage removed by the cattle and that left for the elk and deer. These results are being analyzed.

Subdivision activities were monitored and changes were suggested when wildlife values could be enhanced.

Recovery of a Ground Squirrel Population Following Applications of 1080 and Effects of the Poisoning Program on Coyotes

Project Leader:	B.W. O'Gara
Student Investigator:	T. Lingel-Pate
Cooperators:	Montana Department of Agriculture, Environmental Management Division; Missoula County Rodent Board; Montana Department of Fish, Wildife and Parks; USDI Fish and Wildlife Service, Denver Serv. Center

Objectives:

1. Measure the degree of ground squirrel reduction achieved by 1080 poisoning.
2. Quantify reproductive performance in treated and untreated ground squirrel populations.
3. Compare dispersal rates of young (juvenile and yearling) squirrels between treated and untreated populations.
4. Identify the source of immigrants that appear on treated areas.
5. Measure coyote population fluctuations on treated areas.
6. Investigate utilization of 1080 killed ground squirrel carcasses by ravens and coyotes and associated mortality.

Results:

Pre- and post-treatment density estimates on the treated area indicated a ground squirrel reduction of at least 95%.

Comparisons of reproductive rates in treated and untreated ground squirrel populations provided no support for the hypothesis that reproductive rates in treated populations may exceed that of untreated populations.

Dispersal rates of yearlings were comparable in treated and untreated ground squirrel populations.

Approximately 300 ground squirrels were trapped and marked in unpoisoned perimeter areas to identify the source of recruitment on treated areas. The effectiveness of a 250 yard buffer zone for target areas was judged to be questionable on the basis of preliminary recaptures of marked perimeter squirrels.

The results of coyote scat collection routes used to monitor fluctuations in the population indicated that the coyote population was not significantly reduced as a result of the 1080 application.

One coyote and nine raven carcasses were discovered on the treated area following application of 1080. Necropsies and lab analysis for 1080 residue indicated that these animals had been killed by 1080 through secondary poisoning.

The density of ground squirrels on the treated area and circumstances that result in unusually large numbers of nontarget animals on the treated area were suggested as important factors influencing the extent of nontarget mortality.

Moose-habitat Relationships in the Yaak Country, Northwestern Montana

Project Leaders:	L. Metzgar and J. Ball
Student Investigator:	R. Matchett
Cooperators:	US Forest Service, Forest and Range Experiment Station; Kootenai National Forest, and Montana Department of Fish, Wildlife and Parks.

Objectives:

1. Document seasonal habitat selection by moose in representative portions of the Yaak country.
2. Assess the impacts of logging on moose habitats, populations and behavior.
3. Describe seasonal movement patterns of moose.
4. Develop guidelines for logging that will optimize benefits and minimize disturbance to moose.

Results:

The student investigator was in the field from 5 June until 1 September 1981; 69 moose (Alces alces shirasi) sightings were recorded. Attempts were made to individually identify 24 moose by bell shape, antler shape, pelage marking, and presence or absence of calves. Of these 24 moose, the student investigator feels confident about identifying only 9. Capture efforts on moose for radio instrumentation were unsuccessful. Efforts to capture moose will resume on 5 January 1982, and continue through March.

The student took courses during fall quarter. After the winter field season he will attend classes spring quarter.

Summer Range Ecology of White-tailed Deer in the Coniferous Forests of Northwestern Montana

Project Leader:	B.W. O'Gara
Student Investigator:	R. Leach
Cooperators:	Montant Department of Fish, Wildlife and Parks

Objectives:

1. To determine basic summer habitat use by white-tailed deer in the Swan Drainage.
2. To evaluate the possible influences of fire and logging on summer habitat.

Results:

The student monitored 10 radio-equipped deer during summer 1980 and 18 during summer 1981; 8 were followed both years. She recorded deer locations on 4 inch to the mile aerial photographs. Deer were located by ground tracking and several tracking flights from a fixed-wing airplane.

Summer ranges averaged 186 acres, each mapped according to habitat type, cover type, percent canopy coverage, topographic feature, and successional stage. Preliminary findings indicate deer summer throughout the Swan Valley at low to mid elevations. Summer ranges are composed of activity centers near riparian habitat, and comparatively larger foraging areas in upland habitat. The timbered areas are very diverse with respect to habitat type.

Home ranges of 12 deer included clearcuts. Heaviest use occurred in cuts with extensive visual cover, and cuts with riparian habitat. Of 515 relocations for both field seasons, 195 were in timbered areas, 186 in unlogged riparian habitat, 82 in logged uplands, and 52 in logged riparian habitat.

Three deer were monitored for a 24-hour period to establish circadian activity in relation to habitat and cover type. Data analysis is continuing.

To compare home ranges with unsampled portions of the study area, the student created 15 "random home ranges" that mimic true home ranges in size and shape. These were distributed randomly over the available summer range in the study area, and mapped as true home ranges were mapped. Preliminary results show random ranges are less diverse than true home ranges.

The thesis should be completed in spring 1982, and the abstract will appear in the next biannual report.

Grizzly/Black Bear Interactions and Competition

Project Leader:	C. Jonkel
Student Investigator:	H. Carriles
Cooperators:	US Fish and Wildlife Service; National Park Service; Montana Department of Fish, Wildlife and Parks; US Forest Service; University of MT

Objectives:

1. Determine similarities and/or differences between grizzly and black bear food habits from scat analysis.
2. Compare the habitat component preferences of both species:
   a) On an individual home range basis where a grizzly and a black bear overlap.
   b) By differences between species within the study area.
3. Evaluate grizzly and black bear food habits in the context of phenology, productivity, and nutrient content of certain important plant foods.
4. Compare the feeding strategies of both species. Identify and investigate temporal and/or spacial separation or exclusion on preferred feeding sites.

Results:

The student investigator was in the field until mid-November. Four black bears were redio-tracked to their dens in late October and early November. One sub-adult female remains missing since August and an adult male dropped his radio collar in early November-just prior to denning.

Intensive radio-tracking was continued throughout the period. Limited trapping in September resulted in two grizzly bear captures.

One adult female black bear with three cubs was drugged free-ranging and re-collared 12 hours after she had dropped her radio collar. Four black bears remain with functioning radio transmitters with one additional bear missing. Eight grizzly bears continue to carry functioning transmitters.

Analysis of scat contents began in mid-November. Radio-location data are being plotted and coded for computer analysis in late winter or early spring.

Productivity, Nest Site Characteristics, and Food Habits of Long-eared Owls in the Snake River Birds of Prey Area

Project Leader:	B.R. McClelland
Student Investigator:	J.S. Marks
Cooperators:	USDI Bureau of Land Management, Snake River Birds of Prey Research Project; New Jersey Raptor Association

Objectives:

1. To determine the nesting density and annual productivity of Long-eared Owls in the Birds of Prey Area.
2. To determine the influence of nest site characteristics on the nesting success of Long-eared Owls.
3. To determine the food habits of nesting Long-eared Owls.

Results:

The student investigator recorded 46 nesting attempts by 41 pairs of Long-eared Owls (Asio otus) in the Snake River Birds of Prey Area in 1981. In all cases, eggs were laid in the abandoned nest of a Black-billed Magpie (Pica pica) or a Common Crow (Corvus brachyrhynchos). The student investigator banded 115 nestlings and 6 adults. One hundred-three owls were known to have survived to fledging age. Twenty-five pairs of owls (61%) raised at least 1 young to fledging age. Despite a decrease of 22 nesting pairs in the study area (63 pairs nested in 1980), nest success and the total number of fledged young increased in 1981. Reasons for the decrease in the number of nesting pairs are not apparent, but increased success was due in part to decreased nest predation.

All 3 of the breeding males banded as nestlings in 1980 were successful in raising young this year.

Food habits analysis is complete; 4,208 prey items were recorded. Dipodomys, Perognathus, Peromyscus, and Microtus, comprised 89% of the prey numbers and 90% of the prey biomass.

Data analysis is in progress and a thesis should be completed in the spring of 1982.

Reproductive Ecology and Habitat Utilization by Richardson's Merlins in Southeastern Montana

Project Leader:	I.J. Ball
Student Investigator:	D.M. Becker
Cooperators:	USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Custer National Forest

Objectives:

1. To locate active nests and describe habitat utilization by quantifying features of nesting and hunting habitat.
2. To determine reproductive success and possible effects of various chemical pollutants on reproduction.
3. To determine timing and duration of nesting activities.
4. To determine prey utilization.
5. To recommend management actions for Merlins and their habitat on the study areas.

Results:

The student investigator was in the field from 10 June until 10 August 1981. Features of nesting habitat were quantified at 11 active nesting sites and at 44 inactive sites. Reproductive performance at 16 nests was documented by visiting the nests throughout the nesting season. Observations on timing and duration of various nesting activities provided documentation of nesting chronology. During the course of the study, 254 prey items were collected and identified. An annual report was completed and submitted to the cooperators.

Field work was completed on 10 August 1981. The student investigator is presently preparing his thesis.

The Food Habits of and Habitat Selection by a Barren Ground Grizzly Female and Cubs, Brooks Range, Alaska

Project Leader:	B.W. O'Gara
Student Investigator:	J. Hechtel
Cooperators:	Alaska Department of Fish and Game, Naval Arctic Research Laboratory, National Wildlife Federation, Wildife Management Institute, National Audubon Society, Theodore Roosevelt Memorial Fund of the American Museum, Arctic Institute of North America

Objectives:

1. To examine in detail the seasonal food habits of a female grizzly and her two offspring, and to provide a general account of bear food habits on the western North Slope.

2. To determine daily movement and activity patterns, seasonal movements and the home range of the bears.
3. To describe and map portions of habitat within the home range of the family group.
4. To determine the seasonal habitat use patterns of the bears.
5. To conduct qualitative analysis of important bear food items.

Results:

The student investigator is working in Alaska and working on his thesis.

The Pathology and Cross-infectivity of Sarcocystis in mule deer, white-tailed deer, and elk

Project Leader:	B.W. O'Gara
Student Investigator:	D.B. Pond
Cooperator:	National Bison Range

Objectives:

1. Examine the development and histopathology of Sarcocystis infections in mule deer.
2. Determine if Sarcocystis from white-tailed deer and elk can be passed through coyotes and infect mule deer.

Results:

Field and laboratory work have been completed. Results are being analyzed and an abstract will appear in the next Biannual Report.

Characteristics of a Hunted Mountain Lion Population (Felis concolor) in Western Montana

Project Leader:	B.W. O'Gara and K.G. Greer
Student Investigator:	K.M. Murphy
Cooperators:	Montana Department of Fish, Wildife and Parks; National Rifle Association; US Forest Service

Objectives:

1. To examine age structure, density, natality, and the distribution of mountain lions in hunted and unhunted drainages of the study area.
2. To investigate hunting pressure and harvest of mountain

lions in the study area, and relate those data to population characteristics.

3. To determine timing and distance of dispersal by young animals and the age of sexual maturity in males.
4. To identify and describe winter habitat requirements of mountain lions in the study area, specifically those relating to the aquisition of prey.

Results:

The student spent summer typing lion habitat. He spent autumn quarter taking courses and is now in the field for the final season.

Ecology and Management of the River Otter in Southwestern Montana

Project Leader:	B.W. O'Gara
Student Investigator:	H. Zackheim
Cooperators:	Montana Department of Fish, Wildlife and Parks; National Wildlife Federation

Objectives:

1. To develop a technique to survey river otter populations.
2. To determine relative densities of otters on area rivers.
3. To identify characteristics of otter habitat.
4. To assess the impacts of harvest on otter populations.

Results:

Thesis in preparation; abstract will appear in the next Biannual Report.

A Study of Social Organization, Social Behavior, and Reproduction in Rocky Mountain Bighorn Sheep on the National Bison Range, Moiese, MT

Project Leader:	D. Jenni
Student Investigator:	J. Hogg
Cooperators:	Montana Fish, Wildlife and Parks Department; National Bison Range; National Rifle Association

Objectives:

1. To compile a catalog of the frequency of occurrence and the social context of selected behavioral acts, with special emphasis on behavior during rut;
2. To characterize social organization using the following parameters: groups size, group sex ratio, group age structure, dispersion of groups and individuals within groups, relative group movement;
3. To determine estrous dates, conception dates, lambing dates and lamb survivorship; and

4. To begin testing certain hypotheses regarding the effects of trophy hunting on bighorn reproduction and sociality. These data - for a non-hunted population - will be compared with similar data for the same population in a later study after trophy hunting has been simulated by removal of three-quarter or greater curl rams.

Results:

The student is in the field for the third and final season. The study will continue through spring 1982.

Ecology of the Bobcat in a Coniferous Forest Environment

Project Leader:	I.J. Ball
Student Investigator:	D. Smith
Cooperators:	Montana Department of Fish, Wildlife, and Parks

Objectives:

1. Describe overall status of western Montana bobcat populations and evaluate their structure and dynamics.
2. Characterize habitat requirements, home range, and general movements.
3. Delineate reproductive processes and relate them to the state of overall population.
4. Evaluate food preferences by stomach analyses and scats.
5. Suggest management options based on the results of this study which could improve management of bobcats.

Results:

The student spent summer quarter in the field tracking cats and habitat typing. Fall quarter was spent taking courses.

Black Bear Ecology and Management in the Northern Conifer-Hardwood Forests of Maine

Project Leaders:	C. Jonkel and L. Pengelly
Student Investigator:	R. Hugie
Cooperators:	Maine Department of Inland Fisheries and Wildlife, University of Montana, University of Maine, National Rifle Association, Penobscot Valley Conservation Association, Border Grizzly Project.

Objectives:

1. To determine black bear habitat and its use by bears in Maine.

    a. Describe available habitat in terms of cover types, topography, current use, and road networks.
    b. Describe bear distribution and movements in available habitat.
    c. Describe patterns of black bear behavior such as seasonal activity, sex and age similarities in movements, and how bears relate to human activity within their range.
2. To describe how black bear habitat can be perpetuated.
    a. Describe the effects of forest practices, fire, and other activities on bear habitat.
3. To describe the basic biological characteristics of black bears on the study area.

Results:

The student investigator turned in a rough draft of his dissertation. The summary should appear in the next Biannual Report.

Habitat Selection, Breeding Biology, and Density of the Mountain Plover (*Charadrius montanus*) on the Charles M. Russell National Wildlife Refuge

Project Leader:	I.J. Ball
Student Investigator:	S. Olson
Cooperators:	U.S. Fish and Wildlife Service, Charles M. Russell National Wildlife Refuge

Objectives:

1. Determine the average nesting densities in several representative black-tailed prairie dog towns used by Mountain Plovers and determine the number and distribution of towns used by Mountain Plovers on the refuge.
2. Determine the nesting success and productivity of these birds.
3. Quantify differences in insect densities and species distribution between prairie dog towns used by Mountain Plovers and adjacent areas.
4. Record general behavior, with special attention given to polyandrous behavior and multiple clutches within breeding pairs.

Results:

Full-time field work was conducted from 8 April to 5 September 1981. Bird densities on prairie dog towns were recorded throughout the season. Mountain Plover were found breeding on 9 prairie dog towns within the study area. Eleven of the 13 nest sites located, were on dog towns. Vegetative measurements were taken at each nest site, including percent cover and maximum height. Courtship and

nesting behavior was observed during April and May. Nesting success was determined and broods were observed from hatching until fledging. Fourteen adults and 86 chicks were captured, weighed, measured and banded with U.S.F.W.S. aluminum bands and colored plastic leg bands. One hundred pit-fall insect traps, 50 on dog towns and 50 on adjacent areas, were randomly located within the study area. Twenty sweep net transects were established on and off dog towns.

Initial analysis of the nest site data has shown no difference between nest site vegetation and vegetation sampled at 5 and 10 meters from the nest site.

Activities for the next field season (April-September) include band-return determination and behavioral observation of marked birds. Surveys of prairie dog towns will again be conducted to determine density and distribution of breeding birds on the study area. Nest sites will be located and vegetative measurements taken. Chicks and juveniles will be banded in an attempt to determine survival and mortality. Insect collections will be made at regular intervals throughout the field season with both pit-fall traps and sweep net transects.

A Comparison of Feeding and Nesting Habitat Use by Woodpeckers in First and Second Year Burns

Project Leaders:	B.R. McClelland, J.H. Lowe
Student Investigator:	M. Harris
Cooperators:	McIntire-Stennis, University of Montana School of Forestry, Champion International

Objectives:

1. To compare woodpecker population densities within and adjacent to the burns.
2. To identify bark- and wood-inhabiting insect species and their distributions within the study areas.
3. To characterize woodpecker foraging habits within the burns.
4. To characterize woodpecker nest sites within and near the burns.
5. To propose management guidelines for post-fire logging which would maintain suitable habitat for woodpeckers and associated cavity nesters.

Results:

Fieldwork is complete and the student investigator is completing her thesis. An abstract will appear in the next biannual report.

Population Fluctuations and Distribution Patterns of Mallards in the Pacific Northwest

Project Leader:	I J. Ball
Student Investigators:	M. Rabenberg
Cooperators:	U.S. Fish and Wildlife Service, Refuge Division, Portland; Battelle Pacific Northwest Laboratories

Objectives:

1. Document factors influencing the number of mallards wintering in the Columbia Basin.
2. Document timing, duration, and distance of mallard feeding flights.
3. Investigate interchange of birds between major nesting areas.
4. Determine food and field-type preferences of wintering mallards.
5. Document any changes in average physical condition of mallards.
6. Study the dynamics of flock composition, flock sizes, sex ratios, and pair status over time and between areas.
7. Analyze band recovery data from mallards banded in the Pacific Northwest.

Results:

Data analysis is complete and approximately 90% of the thesis has been written and edited. Rabenberg is currently working at Northern Prairie Wildlife Research Center. Completion of the thesis and overall project report will be delayed until February 1982.

The Value of Riparian Habitats to Land Birds and the Effects of Livestock Grazing on Avian Community Structure

Project Leader:	R. Hutto
Student Investigator:	S. Mosconi
Field Assistants:	J. Marsluff, S. Hicks, K. Turko
Cooperators:	U.S Fish and Wildlife Service, Denver Wildlife Research Center

Objectives:

1. Compare land bird use of riparian habitats and other forest habitats in western Montana.
2. Evaluate the effects of livestock grazing on riparian vegetation and avian community structure.

Results:

The student investigator has completed field work and is analyzing data and writing her thesis. Expected completion date December 1982.

Movements and Migration Ecology of Bald Eagles Associated with Autumn Concentrations in Glacier National Park, Montana

Project Leader: B. R. McClelland
Research Associates: H. L. Allen, J. G. Crenshaw, P. T. McClelland
Student Investigator: L. S. Young
Cooperators: Alberta Fish and Wildlife Division; USDI, National Park Service (NPS), Glacier National Park and NPS Research Center, University of Wyoming, Laramie; National Audubon Society; Montana Forest and Conservation Experiment Station; Wildlife Management Institute and American Petroleum Institute; USDI, U. S. Fish and Wildlife Service, Office of Endangered Species; University of Montana, School of Forestry; Sigma Xi; USDI, Water and Power Resources Service (Casper, WY; Denver, CO); Colorado Division of Wildlife, Grand Junction; USDI, Bureau of Land Management (Salt Lake City, UT; Vernal, UT; Elko, NV; Boise, ID); Parks Canada, Wood Buffalo National Park; Idaho Department of Fish and Game; Echo Bay Mines, Ltd.

Objectives:

1. To determine migration routes, wintering areas, and summer ranges of bald eagles associated with autumn concentrations in Glacier National Park, Montana.
2. To study local movements and ecology of this group of eagles throughout the course of seasonal movements.
3. To study spatial and temporal relationships among bald eagles, habitats, and specific habitat components through analysis of local and long-range movements and local ecology, and to identify habitats essential to this group of eagles.

Results:

During June and July, summer ranges of 5 adults were confirmed: Leith Penninsula, Great Bear Lake, Northwest Territories (NWT)(1); Windy Bay, Great Slave Lake, NWT (1); Taltson River, NWT (2); and Lake Claire, Alberta (1). Reproductive status of the 6 adults was as follows: 5 paired, 3 occupied territories, and 1 was productive. The productive territory was on Great Bear Lake's Leith Penninsula, 104 km south of the Arctic Circle.

In June, the molted transmitter package of a juvenile was detected at Lake Claire. This juvenile was not in the Lake Claire vicinity during early May. Data suggest that subadults, without the stimulus of a reproductive committment and in the face of severe cold and scarce food, move north substantially later than do adults.

In July, the Oregon rancher accused of the January 1981 killing of 1 of the experimental subadult on the Snake River near Ontario pled guilty in federal court to the killing. He was fined $2,500 and received a suspended 30-day jail sentence. This is the most severe penalty ever levied for violation of the 1948 Bald Eagle Protection Act.

In October, McClelland, Allen, McClelland, and Young traveled to the First International Bald Eagle/Osprey Symposium at Montreal, Quebec. They presented 2 papers: Long-range movements of bald eagles associated with autumn concentrations in Glacier National Park, Montana: a preliminary report and The concentration of bald eagles in Glacier National Park, Montana: an international perspective.

On 3 November, the adult associated with the Windy Bay nest site was recovered (dead) from a strychnine-laced coyote bait near Peace River, Alberta, midway between her nesting territory and Glacier National Park. At the time of her death, she was accompanied by another adult, presumably her mate, and appeared to be returning to Glacier.

Young will finish coursework during winter and will complete his academic program during spring.

CONSERVATION, EDUCATION, AND PUBLIC RELATIONS

Bart O'Gara

5 July	Presented a 2-hour lecture on predation to 18 graduate students from Harvard and the University of Iowa.
6 July	Participated in a meeting to select projects to be funded by the McIntire Stennis program.
14 July	Presented a 2-hour lecture on safety in wildlife work to 60 USFS employees.
15 July	Attended a meeting in Helena regarding 1080 use in predator and rodent control.
21 July	Met with Foresty School Dean and Wildlife program personnel to discuss the future of the Wildlife program at the University.
15-28 July	Spent approximately 6 hours in telephone conference with individuals from numerous organizations and agencies ragarding biological effects of 1080.
28 July	Conducted a wolf recovery team meeting attended by 8 team members and 8 observers. They voted unanimously to seek a zoning system around parks and wilderness areas. Such a system should help to make reintroductions and management efforts acceptable to livestock growers.
30-31 July	Attended the Border Grizzly and Wolf technical session at Whale Creek, Montana to present and discuss the wolf recovery plan.
1 August	Met with Region Six Director at Whale Creek, MT to discuss Wolf management.
12-13 August	Attended project leaders meeting in Billings Area Office and presented a slide assisted summary of Unit projects.
28 August	Participated in an all day meeting to set research priorities for 1080 research at MT Dept. of Agriculture Headquarters in Helena.
August	Reviewed 26pp and 11pp manuscripts for J. Wildl. Manage., 6pp for Wildl. Bulletin, 74pp for the Council for Agricultural Science and Technology goat and sheep task force, and a 61pp research proposal for MT Dept. of Agriculture.

13 October	Presented a seminar on mammalian carnivores to a "Montana Wildlife" class (Zoo. 201)--65 students.
2-3 November	Captured a bighorn ram on the Bison Range and transported it to C.M. Russell NWR to replace their only breeding-age ram which had disappeared.
18 November	Met with new University President Bucklew and Forestry Dean Stout to report on the Unit program.
19 November	Attended Montana Council on Environmental Quality (citizen and state legislator group) meeting to discuss Endrin and 1080.
1-2 December	Attended a Northern Rocky Mountain Wolf Recovery meeting in Boise.
4 December	Collected and necropsied a bighorn sheep at the Bison Range for the Advanced Wildlife Conservation Class (For. 475)--34 students.
7 December	Attended meetings with NWF personnel regarding access to Federation lands near Grant Creek.
9 December	Presented a lecture and demonstration to wildlife graduate students on handling and processing big game meat.
15 December	Presented the wolf recovery plan to area ADC personnel in Billings.
16 December	With Ball completed preliminary negotiations with Dean Murray on a new master cooperative agreement for Unit operations.
22 December	Reviewed a 5-page manuscript for Denver WRC biologist.
22 December	Attended meetings with NWF personnel regarding access to Federation lands near Grant Creek.
23 December	With Ball, reviewed 2, 2-page manuscripts being submitted for publication by UM undergraduate wildlife students.

Joe Ball

15 July	Toured CMR NWR with Manager Friez, discussing current mountain plover research in relation to refuge management needs.
21 July	Reviewed a 10 page manuscript for the J. of Wildl. Manage.

August	With O'Gara, reviewed a 61pp research proposal for MT Dept. of Agriculture.
10 September	Reviewed a 15 page manuscript for USFWS-Refuge Division.
28-29 September	Met with US Dept. of Energy personnel to discuss potential bobcat research on INEL site.
2-3 November	With O'Gara, captued a bighorn ram on the Bison Range and transported it to C.M. Russell NWR to replace their only breeding-age Ram, which had disappeared.
15 November	Discussed possible Unit involvement in a fish and wildlife data retrieval program with Ken Russell, WER, and Charles Cushwa, EELUT.
10 November	Presented a lecture on waterfowl and gallinaceous birds to Montana Wildlife (Zoo 201)--70 students.
2 December	Met with personnel of MT FWP and Burlington Northern regarding possible turkey introductions and research projects.
8 December	Met with personnel of BLM and Burlington Northern regarding possible turkey introduction and research projects.
15 December	Summarized Unit activities in meeting with University President Bucklew.
22 December	Met with USFS personnel regarding a possible research project on elk/powerline interaction.
23 December	Reviewed a 33-page manuscript for J. Wildlife Management.
October-November	Conducted instruction for 30 students assisting FWP personnel at hunter check stations, assigned students to check stations, and organized their transportation. Students will be required to write a paper on their experience.
October-December	Conducted a graduate level seminar during the quarter-"Logic and Design of Research Projects" -W. Biol. 570--11 students.
sporadic	Discussed fish and Wildlife information retrieval system with MT FWP personnel.

Pam Knowles

Presented lectures on bobcats to freshmen wildlife biology class and to Sigma Xi.

Attended American Ornith. Union meetings in Edmonton.

Jack Connelly

1-3 September	Attended the 12th Western States Sage Grouse Workshop in Bowman, North Dakota, and presented a paper entitled "Winter flocking behavior and habitat use by sage grouse in southeastern Idaho.

Len Young

26-27 October	Attended First International Bald Eagle/Osprey Symposium, Montreal, Quebec-presented paper: "Long-range movements of bald eagles associated with autumn concentrations in Glacier National Park, Montana: a preliminary report".
28 October- 2 November	Attended Raptor Research Foundation meeting, Montreal, Quebec.
10 November	Spoke to Univ. MT Chapter, The Wildlife Society: Glacier National Park's bald eagles: where do they come from and where do they go?

Dale Becker

6 October	Presented a talk on the ecology of Merlins and Prairie Falcons in eastern Montana to the Montana Wildlife class.
14 December	Presented a talk on Merlin and Prairie Falcon research in eastern Montana to the Five Valleys Audubon Chapter.
30 October- 2 November	Attended a Raptor Research Foundation Annual Meeting in Montreal, Quebec.

Mary Harris

August	Attended the Am. Ornith. Union meeting in Edmonton, Alberta and presented a paper titled: "Foraging site partitioning among woodpeckers in first and second year post-fire forest habitat."

Jeff Marks

3 October	Presented paper at the annual meeting of the Idaho Ornithological Council: "Nesting Biology of Long-eared Owls in the Snake River Birds of Prey Area."

Harry Carrlies

30 July- 1 August	Border Grizzly Technical Committee Meeting: -Gave a short presentation on graduate research project.

	-co-conducted tour of bear habitat and timber harvest activities with George Wilson, FS, Silviculturist, Glacier View R.D.
14 August	Attended Congressional hearing on Glacier National Park Bear Management in West Glacier, MT.
16 November	Lectured on Bear Research to 2 science classes at Columbia Falls High School.

Tim Lingel-Pate

Presentations on the preliminary results of study were given to the Missoula County Rodent Board and the Montana Rodent Damage Control Council.

Darrel Weybright

4 December	Presented a statement of concern before the Missoula County Commissioners regarding fence dimensions and deer migration in the Grant Creek drainage.

Jo Meeker

August-September	Participated in orientation for hunters at Hart Mountain National Wildlife Refuge, Oregon and Sheldon Antelope Range, Nevada.
November	Presented one-hour lecture on Home Range Determination to Wildl. Bio. 570 (12 students).

PUBLICATIONS

Amstrup, S.C., J. Meeker, B.W. O'Gara, and J. McLucus. 1980. Capture methods for free-ranging pronghorns. Proc. Biennial Pronghorn Antelope Workshop 9:98-131.

Ball, I.J., E.L. Bowhay, and C.F. Yocom. 1981. Ecology and management of the western Canada Goose in Washington. Wash. Dept. Game, Biol. Bull. 17. 68pp.

Bodie, W.L. and B.W.O'Gara. 1980. A description of "weak fawn syndrome in Pronghorn Antelope." Proc. Biennial Pronghorn Antelope Workshop 9:59-70.

Butts, T.W. 1980. Population characteristics, movements, and distribution patterns of the Upper Rock Creek bighorn sheep. Proc. Bien. Symp. Northern Wild Sheep and Goat Counc. pp. 115-140.

Connelly, J.W. and R.J. Gates. 1981. First record of a black-legged kittiwake in Idaho. Condor 83:272-273.

Jenni, D.A. and T. Bicak. 1981. Shortgrass Uplands-Relic Sagebrush. Amer. Birds. 34:78.

Redmond, R., T. Bicak, and D. Jenni. 1981. An Evaluation of Breeding Season Census Techniques for Long-billed Curlews (Numenius americanus). in Estimating Numbers of Terrestrial Birds, C.J. Ralph and J.M. Scott, eds. Studies in Avian Biol. 6:197-201.

Sheldon, A.L. and R.A. Haick. 1981. Habitat selection and association of stream insects: a multivariate analysis. Freshwater Biology 11:395-403.

REPORTS SUBMITTED

Becker, D.M. and I.J. Ball. 1981. Impacts of surface mining on North American merlins: recommendations for monitoring and mitigation. 35pp. Submitted to USFWS, Office of Biological Services.

Becker, D.M. and I.J. Ball. 1981. Impacts of surface mining on prairie falcons: recommendations for monitoring and mitigation. 39pp. Submitted to USFWS, Office of Biological Services.

DeWaard, B.K. 1981. Impacts of surface mining on black hawks: recommendations for monitoring and mitigation. 21pp. Submitted to USFWS, Office of Biological Services.

Kraft, S.K. 1981. Impacts of surface mining on western grebes: recommendations for monitoring and mitigation, 26pp. Submitted to USFWS, Office of Biological Services.

Marks, J.S. and I.J. Ball. 1981. Impacts of surface mining on burrowing owls: recommendations for monitoring and mitigation. 36pp. Submitted to USFWS, Office of Biological Services.

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BIANNUAL REPORT

of the

MONTANA COOPERATIVE WILDLIFE RESEARCH UNIT

University of Montana

Missoula, Montana

to

UNIVERSITY OF MONTANA

MONTANA FISH, WILDLIFE, AND PARKS COMMISSION

WILDLIFE MANAGEMENT INSTITUTE

U.S. FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR

Vol. 31, No. 2
January-June 1981

Respectfully submitted,

Bart O'Gara
Bart W. O'Gara, Leader

Joe Ball
Joe Ball, Ass't Leader

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MONTANA COOPERATIVE WILDLIFE
RESEARCH UNIT PERSONNEL

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W. Leslie Pengelly, University of Montana, Missoula
Bart W. O'Gara, U.S. Fish and Wildlife Service, Missoula

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COOPERATING AGENCIES

University of Montana
Montana Fish, Wildlife, and Parks Department
Wildlife Management Institute
U.S. Fish and Wildlife Service

Alaska Fish and Game Department
Arctic Institute of North America
Audubon Society
Border Grizzly Project
Bureau of Indian Affairs
Bureau of Land Management
Champion International
Charles M. Russell National Wildlife Range
Confederated Salish and Kootenai Tribe
Denver Wildlife Research Center
Environmental Research Institute
Flathead National Forest
Harriman State Park
Idaho Cooperative Wildlife Research Unit
Idaho Department of Fish and Game
Idaho National Engineering Laboratory
Malaysia Department of Wildlife and National Parks
McInntire Stennis
Montana Departments of Agriculture and Livestock
Montana Fish, Wildlife and Parks Department (Bozeman Laboratory)
Montana Forest and Conservation Experiment Station
National Bison Range
National Geographic Society
National Rifle Association
National Wildlife Federation
Nature Conservency
Naval Arctic Research Laboratory, University of Alaska
Nevada Department of Fish and Game
Nevada Department of Wildlife
Refuge Division, Portland
Smithsonian - Peace Corps Environmental Program
Targhee National Forest
Theodore Roosevelt Memorial Fund of the American Museum
U.S. Department of Energy
U.S. Forest Service
U.S. National Park Service
U.S. Peace Corps, Malaysia
University of Montana Foundation
University of Montana School of Forestry

Wildlife - Wildlands Institute
World Wildlife Fund International
Wyoming Department of Fish and Game
Yellowstone National Park

PERSONNEL NOTES

Randy Olson, Unit graduate student and resident of Richland, Washington, was killed in an automobile accident on March 16. Randy came to the Unit with high recommendations based on his previous work in Washington and Idaho. In the short time he was with us, he demonstrated levels of knowledge, motivation, and perseverance that will be sorely missed.

Many changes have been made in YACC personnel. Tracie Legg finished her year on 31 March and is currently looking for an outdoor job. Sheryl Jackson and Brian Giddings joined us in December. Sheryl graduated from Stevensville High School and attended the Missoula Vocational Technical Center; she is a happy addition to our office. Brian has a B.S. from U. of M. in wildlife biology and is a capable field man. Rick Levesque joined our crew in April: Rick was an undergraduate in wildlife biology and originally came to the Unit two years ago as a summer volunteer from Massachusetts. Sally Sovey, who has a B.S. in Zoology from Oregon, has returned to finish out her final six weeks of YACC just in time to assist with the windup of the Flathead Goose Study. Our fifth YACC, Susan Kraft, can't be called a new face at the MT CWRU: I guess you'd call her our senior YACC now, and we're really glad to say she is still on board. Susan has a B.S. in Zoology from U. of M. and is one of those rare individuals who is equally efficient in the office or in the field.

RESEARCH PROJECTS

Physiologic and Ecologic Studies of the Pronghorn (*Antilocapra americana*)

Project Leader: B. W. O'Gara
National Bison Range, U.S. Fish and Wildlife Service; Yellowstone National Park, U.S. National Park Service; and the Montana Fish, Wildlife and Parks Department

Objectives:

To study:

1. the reproductive physiology of male and female pronghorn;
2. the physiology and function of scent glands;
3. food habits related to changes in range conditions;
4. horn growth and casting; and
5. the relationships of pronghorns to other artiodactyls.

Results:

Two papers were given at Symposia on data gathered during this study, one popular article was published, and work was continued on the pronghorn book.

Population Studies of Canada Geese in the Flathead Valley

Project Leaders: J.J. Craighead and I.J. Ball

Objectives:

1. To gather current data on populations, nesting areas, and nest success of Flathead geese.
2. To compare the current situation with conditions documented during 1953-60.
3. To relate changes in reproductive output of the geese to changes in habitat or management strategies since the 1950's.
4. To prepare a monograph using both historical and current data.

Results:

The final field season was completed and the results are being analyzed. Anticipated date of monograph completion is December 1982.

Pronghorn Antelope Behavior in Northwestern Nevada - Southeastern Oregon

Project Leader: B. W. O'Gara
Student Investigator: J. O. Meeker
Cooperators: U.S. Fish and Wildlife Service, NRA

Objectives:

1. To determine seasonal movements of pronghorns (Antilocapra americana) that summer on Hart Mountain and Sheldon Antelope Refuges.
2. To determine breeding strategies used by pronghorn with home ranges in two habitat types (Low Sage-Bunchgrass and Playa).
3. To analyze any differences noted in objective 2 above in an ecological and behavioral framework.
4. To determine trace element content of vital organs and hair of pronghorn taken at Sheldon and Hart Mountain Wildlife Refuges.
5. To establish trace element baseline data for pronghorns at Sheldon and Hart Mountain Wildlife Refuges.
6. To compare trace element data from Sheldon and Hart Mountain with hair taken from Idaho and Montana pronghorns.

Results:

Location flights were made during January, February and April. One female died between last September and the January flight. Two radio transmitters failed between the January and February flights, one in each study area.

The mild and extremely dry winter at Sheldon caused little movement of resident animals. Pronghorn, including one collared animal, wintered on Horse Heaven. A recently retired 14-year employee of Sheldon stated that, to his knowledge, this had not occurred during his tenure. Hart Mountain pronghorns followed the same movement patterns as last year.

Eight active transmitters remain on study animals, four at each study area. Location flights are planned for next winter should it appear justifiable.

Financial assistance was obtained from the National Rifle Association. The student investigator attended classes during the winter quarter and is presently in the study area.

Inventory and Analysis of the Range and Wildlife Resources, Wildhorse Island, Flathead Lake, Montana

Investigator:	L. Eddelman
Student Investigator:	D. Kautz
Cooperators:	Montana Fish, Wildlife and Parks Department, Nature Conservancy

Objectives:

To provide baseline data on the Island range and wildlife resources in order to evaluate, classify, and manage such resources relative to present and future goals and objectives. The inventory shall be aimed at total Island ecology rather than emphasizing specific factors pertaining to particular wildlife species

Results:

Wild Horse Island became a state park in early 1978. The purpose of this study was to provide baseline data for park management and development. A variety of objectives were pursued by past Island developers. Significant impacts included the introduction of bighorn sheep (Ovis canadensis), mule deer (Odocoileus hemionus), and horses (Equus caballas); subsequent overgrazing; and the introduction of many highly competitive alien plant species.

The Island landscape, which is typically steep and rugged, was subdivided into 2 landsystems and 9 landtypes based on geomorphology and and landscape configuation. Island soils are mostly weakly developed and very gravelly. Common grassland soils are Haploxerolls and Haploborolls; common forest soils are Ustochrepts and Xerochrepts. A total of 9 soil series were described.

Island vegetation was described according to 7 habitat types and 14 cover types. The northside and most of the shoreline supports dry Pinus ponderosa and Pseudotsuga menziesii forest types. Most Pseudotsuga menziesii is moderately to severely infested with Arceuthobium douglasii and in deteriorated condition. The southside supports mountain bunchgrass grasslands at climax dominated by Festuca scabrella and Agropyron spicatum. Disclimax vegetation, dominated by Bromus tectorum and Poa pratensis, occupies most grasslands at present. Range condition is generally poor to fair. Where native bunchgrasses still dominate, range condition is good. No indications of an upward trend in range condition were observed in any grassland cover type. Morphologic and physiologic adaptations of Bromus tectorum and Poa pratensis indicate that intensive management treatments are necessary to promote improved range condition where those species dominate.

The Island flora included 283 vascular plants, 23% of which were introduced. One endangered species, Silene spauldingii, was found on the Island.

The Island fauna included 102 birds and 11 mammals. Mammal species diversity was greater historically. Observations indicate that bighorn sheep habitat selection is correlated to both vegetative structure and landform. Mule deer habitat selection is correlated to vegetative structure. Six species of diurnal raptors, including a Bald Eagle pair, nested on the Island during this study.

Forage Selection and Habitat Use of the Sumatran Rhinoceros in Malaysia.

Project Leader:	B. W. O'Gara
Student Investigator:	R. Flynn
Cooperators:	Malaysia Department of Wildlife and National Parks, World Wildlife Fund International

Objectives:

1. To determine the kinds, relative amounts, and characteristics of forage selected by the Sumatran rhino (Dicerorhinus sumatrensis) in the Endau-Rompin area of southern Penisular Malaysia.
2. To describe the habitats used by the rhino, especially at feeding sites.

Results:

The student investigator is in Malaysia collecting data. He will return to the University in summer 1981.

Movements and Habitat Utilization of American marten in Glacier National Park, Montana

Project Leader:	B. R. McClelland
Student Investigator:	G. Burnett
Cooperators:	U.S. Fish and Wildlife Service, U.S. National Park Service, University of Montana

Objectives:

1. To document marten movements and activity patterns.
2. To describe habitat use by resident and dispersing marten.
3. To investigate fluctuations in a marten population and its prey base.
4. To propose long-term management guidelines for marten habitat in spruce-fir habitat types in western forests.

Results:

Field work was conducted from March 1979 to September 1980. Data were gathered by live-trapping, radio collaring, and relocating marten. Trapped marten were fed and watered, ear-tagged, and weighed; sex and age were determined, general condition, behavior, and breeding condition were also recorded. When a radio collared marten was relocated, its behavior and proximity to vegetation were recorded. In addition, the weather condition, habitat type, cover type, cover class (logs, shrubs, forbs, soil/litter, and rocks), aspect, slope, horizontal configuration, and topography were recorded. Snow quality and quantity, depth of marten tracks, hunting sites, and travel routes were described for winter months. Small mammal plots were snaptrapped to index the prey population. Marten scats were collected along trails. The study area was habitat and cover typed.

A total of 1025 trap days resulted in 69 captures of 29 individual marten. Radio collars were fitted on 6 juvenile (4 male, 2 female) and and 5 adult (3 male, 2 female) marten. Collared marten were located 160 times, primarily by ground tracking. Dispersion analysis showed little intrasexual or intersexual overlap of resident home ranges. Adult males occupied an average home range size of 2.02 km^2 and adult females 0.72 km^2. Juvenile males had home ranges averaging 15.44 km^2; the juvenile female used a 41.15 km^2 home range. Resident juvenile home ranges differed significantly from non-resident juvenile home ranges. All the adult marten were residents while 2 juvenile males established resident home ranges and 2 were non-residents; the juvenile female was a non-resident. Marten moved an average of 0.52 km between consecutive days, ranging from 0.1 to 2.8 km. Non-resident marten averaged longer daily movements than residents. Multi-day movements combined with daily movements were reported using 2 different measures, distance between successive locations and distance between collaring site and relocations. Non-residents traveled significantly farther than residents between initial collaring site and relocations, averaging 3.68 km compared to 0.80 km; 40 daytime resting sites were located. Habitat use by resident and non-resident marten was noted.

The Effects of 1080 Control of Columbian Ground Squirrels on Target and Non-target Mammal and Bird Populations

Project Leader:	B. W. O'Gara
Student Investigator:	J. C. Malloy
Cooperators:	Montana Departments of Agriculture, Livestock, and Fish, Wildlife and Parks.

Objectives:

1. To estimate changes in non-target bird and mammal populations subsequent to treatment on control and experimental areas;
2. To estimate changes in Columbian Ground squirrel population levels subsequent to treatment on control and experimental areas; and
3. To estimate the toxicity of 1080 poisoned ground squirrel carcasses recovered in the field to selected mammalian and avian scavengers.

Results:

An abstract of the thesis follows:

Target and nontarget mortality associated with 1080 control of Columbian ground squirrels (Spermophilus columbianus) were investigated in the Blackfoot Valley of western Montana. Population estimates derived from mark-recapture records of ground squirrels declined to 0 on the treatment area immediately after poisoning. In the following year, population estimates returned to approximately 20% of their former level. Immigrants to the treatment area apparently came from the nearest untreated site (less than 246 feet; 75 m away). Juvenile squirrels were disproportionately less abundant on the treatment area in 1980 than in 1979, the treatment year.

Mark-recapture estimates of small mammal population sizes and capture rates declined immediately after baiting on the treatment area traplines and increased on the untreated area lines. Population estimates declined further over the following winter on both treatment and untreated areas and reached a low point in the spring of 1980. The over-winter decline was greater than the decline following baiting and was presumably a natural, area-wide fluctuation.

Passerine bird population indices varied after baiting but not in a manner attributable to the poisoning campaign. Granivorous birds appeared negligibly affected by 1080 baiting. Recovery of 3 common raven (Corvus corax) carcasses suggested that their population may have been affected.

Carnivore populations were not reliably surveyed. Scent station indices and coyote (Canis latrans) carcass recovery indicated that coyote mortality occurred, but the magnitude of population reduction was not quantifiable. Post-treatment observations indicated that coyotes and other carnivores were not extirpated, even on treated areas. Carcass recovery indicated that mortality may be locally high where carnivores are traditional users of a treated area.

Toxicity testing suggested that coyotes would have little difficulty in acquiring a lethal dose of squirrel carcasses, but that badgers and golden eagles would seldom be able to eat enough carcasses before their decomposition or removal by other species. Monitoring of small mammal carcasses available above ground showed that such carcasses were available to scavengers for less than 2 weeks after baiting.

Pathological signs observed in gross necropsy of coyotes are of value in the diagnosis of 1080 poisoning.

Mission Mountains Grizzly Bear Study

Project Leader:	C. Jonkel
Student Investigator:	C. Servheen
Cooperators:	Bureau of Indian Affairs; Confederated Salish and Kootenai Tribe; U.S. Fish and Wildlife Service; Montana Department of Fish, Wildlife, and Parks; School of Forestry, University of Montana

Objectives:

1. Determine the seasonal habitat preference of grizzly bears in the Mission Mountain area.
2. Determine denning sites and denning activity of grizzlies in the Missions.
3. Determine population status, density, and distribution of grizzly bears on the Mission area.
4. Determine seasonal food habits of grizzlies in the Missions and relate food habits to habitat preferences.
5. Develop a management plan for the Flathead Indian Reservation based on sound biological data from research findings.

Results:

The student investigator completed his dissertation. The abstract follows:

Grizzly bear movements, habitat selection, food habits, and denning activities were studied in the Mission Mountains, Montana from 1976 through 1979. A management plan was developed using these biological data. Fifteen grizzly bears were captured 23 times. Eleven grizzly bears and 2 black bears were radio-instrumented. Home ranges of 6 grizzlies were plotted using 467 radio-locations. Mean home range size was 285 km^2 for females and 1402 km^2 for males, and ranges overlapped between all sex and age classes. Within the 780 km^2 study area, the overall density was 1 grizzly/49 km^2.

A habitat description system using 19 structurally different habitat components was used to describe habitat use. Low elevation wet sites were used more than expected ($p < 0.05$) in spring. Seep areas and alpine slabrock were used more than expected ($p < 0.05$) in summer. Wet meadows, riparian areas, and alpine slabrock were used more than expected ($p < 0.05$) in autumn. Grizzly bears in the Mission Mountains were seasonal altitudinal migrants.

Food habits varied by season. Spring foods included graminoids, forbs and ferns, and carrion. Summer foods included forbs, graminoids, shrub fruits, insects, and Equisetum spp. Autumn foods included tree fruit, shrub fruit, insects, graminoids, and carrion. Concentrations of army cutworm moths (Chorizagrostus auxiliaris) in alpine talus fields provided an important source of protein for grizzly bears in late summer.

Forty-one grizzly bear dens were located, and 10 of these were used by radio-instrumented grizzlies. Thirty-nine dens were located in open, side-hill park habitat between 2050 and 2500 m. Dens occurred on all aspects except northwest. Movement to the den was independent of weather and occurred between 10 October and 20 November. Final den entry was associated with severe snowstorms at the den site. Emergence dates varied from prior to 31 March to 26 April. Females with young stayed at the den site for 7 to 12 days after emergence. One grizzly used its winter den as a summer bedding site in August.

Continued existence of grizzly bears in the Mission Mountains will require application of biologically sound guidelines pertaining to land development, forestry and road practices, domestic livestock hunting, and problem bear control. The current grizzly population in the Missions is estimated at 25. Maintenance of a corridor to adjacent occupied grizzly bear range will be necessary to preserve a grizzly population in the Mission Mountains.

Wintering and Nesting Behavior of Trumpeter Swans

Project Leader:	R. L. Hutto
Student Investigator:	P. Hampton
Cooperators:	U.S. Fish and Wildlife Service, Harriman State Park, Targhee National Forest

Objectives:

1. To quantify plant and animal materials eaten by Trumpeter Swans on the Henry's Fork during winter.
2. To quantify the structural (vegetative or physical) features that are necessary to provide nesting and feeding areas during winter
3. To quantify plant and animal material located inside exclosures that would be utilized if the barriers were absent
4. To establish time budgets for the swans on the breeding range in the Targhee National Forest to determine the amount of time spent on the nest.
5. To establish nest temperature records to determine the extent of egg cooling.

Results:

Beginning in mid-November 1980, observed swan behavior was again studied within Harriman State Park. Observation points were also established in Yellowstone National Park along the Madison River. The points in Yellowstone were added to discern the effects of human activity on the wintering Trumpeters. The percentage of daylight hours spent in various behavior categories did not vary significantly as a function of either human activity or weather. Because of the unusually warm weather in January, swans were not forced to congregate on the large rivers. The Harriman Park census in January never exceeded 200 swans, yet the USFWS mid-winter aerial census documented an all time high of 1247 swans. By the end of February, the majority of swans had left the Tri-state Region, and observations were stopped on 2 March 1981.

Only one dead swan was recovered during the winter of 1980-81, a cygnet found at Golden Lake in Harriman State Park that was too decomposed for determining cause of death. A second swan, recovered in September at Mac's Inn, Idaho, died from peritonitis that probably resulted from a gunshot wound.

Band sightings this winter again showed that the majority of the swans on the Henrys Fork River and in Yellowstone Park are from Canada. No Alaska-banded birds were observed, but swans banded at Red Rock Lakes Refuge were occasionally sighted. One of these Red Rock swans was banded over 20 years ago.

On 18 May, incubation began on both nests on Silver Lake. One of the nests was used the previous year and contains 5 eggs. The second nest is approximately 200 m away in plain view of the first nest and contains 7 eggs. The nest monitoring equipment was installed on both nests at the start of incubation. The nest that were monitored last year could not be studied this year because snowmobiles destroyed the nest at Swan Lake and the pair at Chain Lake never nested. Heavy rains have raised the level of many of the rivers and lakes this spring, resulting in a high rate of nest abandonment.

Throughout the rest of the spring, we will continue to monitor nest activities and cygnet survival. By 1 July, all field work will be completed.

Habitat Selection, Populations, and Control of Black-Tailed Prairie Dogs (*Cynomys ludovicianus*) on the Charles M. Russell National Wildlife Range

Project Leader:	B. W. O'Gara
Student Investigator:	C. Knowles
Cooperator:	U.S. Fish and Wildlife Service, Charles M. Russell National Wildlife Range

Objectives:

1. Determine distribution, size and status of all prairie dog towns within the Wildlife Range;
2. determine habitat selection by prairie dogs within the Wildlife Range;
3. determine population dynamics of prairie dogs and identify environmental factors which may influence numbers of prairie dogs within and between years within a prairie dog town;
4. investigate the dynamics of colonization by prairie dogs of the Wildlife Range;
5. evaluate and compare the effectiveness of three possible methods of control--poisoning, shooting and habitat alteration; and
6. investigate the association and relationship of prairie dogs to areas of intensive livestock use and/or areas of human disturbance.

Results:

The student investigator has completed his field work and is analyzing data. The dissertation should be completed by December 1981.

Morphological Variations Within the Subspecies *Ursus arctos horribilis*

Project Leaders:	P.L. Wright
Student Investigator:	H. W. Sherwood
Cooperators:	Montana Department of Fish, Wildlife and Parks, Bozeman Laboratory; Western Wildlands

Objectives:

1. To develop new procedures for accurately measuring variations in cranial characteristics with regard to age and sexual dimorphism; and
2. to further clarify understanding of the systematics of the brown/grizzly bear complex in North America.

Results:

The student investigator is analyzing data and writing his thesis. A summary should appear in the next biannual.

Winter Ecology of Mule Deer in the Rattlesnake Gulch Area

Project Leader:	I.J. Ball
Student Investigator:	R. Yeager
Cooperators:	Confederated Salish and Kootenai Tribes; Bureau of Indian Affairs; National Rifle Association

Objectives:

1. Document the relative importance of various habitat types to the mule deer that winter in the Rattlesnake Gulch Area.
2. Describe movement patterns of the deer and distribution on the winter range.
3. Estimate population size and age/sex composition.

Results:

Field work was completed at the end of March. The student is currently working on data analysis and taking course work toward completion of degree requirements. Tentative date for thesis completion is June 1982.

A Study of Social Organization, Social Behavior, and Reproduction in Rocky Mountain Bighorn Sheep on the National Bison Range, Moiese, Montana

Project Leader:	D. Jenni
Student Investigator:	J. Hogg
Cooperators:	Montana Fish, Wildlife, and Parks Department; National Bison Range; National Rifle Association.

Objectives:

1. To compile a catalog of the frequency of occurence and the social context of selected behavioral acts, with special emphasis on behavior during rut;
2. To characterize social organization using the following parameters: group size, group sex ratio, group age structure, dispersion of groups and individuals within groups, relative group movement:
3. To determine estrous dates, conception dates, lambing dates and lamb survivorship; and
4. To begin testing certain hypotheses regarding the effects of trophy hunting on bighorn reproduction and sociality. These data - for a non-hunted population - will be compared with similar data for the same population in a later study after trophy hunting has been simulated by removal of three-quarter or greater curl rams.

Results:

The study is ongoing. All animals are individually known by natural or artificial horn marks. Approximately 1200 hours of structured behavioral observations, 400 hours of census during (1979 and 1980) and 400 hours of census during lambing (1980 and 1981) are completed. The study will continue through spring 1982.

Elk Habitat Selection and Use, Movements, and Home Range on a Disturbed Summer Range in Western Montana

Project Leader:	C. L. Marcum
Student Investigator:	J. Lehmkuhl
Cooperators:	Bureau of Land Management, Montana Forest and Conservation Experiment Station

Objectives:

1. Describe environment available to elk.
2. Describe elk habitat selection and use, movements and home range on a forested summer range subject to concurrent logging.
3. Compare data with information obtained in the "pre-disturbance" phase of the long-term study.

Results:

The student investigator completed his thesis, the abstract follows:

Elk movements and habitat selection were studied from May through November during 1977, 1978, and 1979. Thirty-one elk, equipped with radio-transmitter collars, were located 979 times from an airplane. Elk trapped at the Lindbergh and Potter traps primarily used an area of about 70 square miles (181 km^2), whereas elk trapped at Grace's Landing used an area of about 30 square miles (78 km^2). There was very little mingling of these 2 groups, and a remarkable fidelity to group home range boundaries was observed. Spring-fall use of the Core Study Area (CSA) was significantly greater than availability for all 3 years. During calving and summer seasons, most activity was in and near the north and west sides of the CSA. Elk ranged widely during the rutting season, generally dispersing from areas of summer use. Activity centers were grouped during the hunting season, mainly in areas about 2 miles (3.2 km) from the nearest hunter access point. Elevations from 5700 to 6200 feet (1740-1890 m) were consistently selected for. Ridgetops were selected for during 1978 and 1979, but use was greatest on upper and mid-slopes. Concave slope configurations were usually preferred. Northeast aspects were overall the most preferred aspect. Distance to water did not influence elk distribution; however, water and moist sites were readily available throughout the study area. Little preference was shown for canopy cover. Pole-young, mixed species stands were used the most, but only mature-old, mixed species stands were preferred. The ABLA/CACA habitat type was most preferred, followed by the ABLA/LIBO, ABLA/XETE-VAGL, PSME/CARU, and ABLA/MEFE types. Open roads were not avoided during the calving and summer seasons, but areas within 550 yards (500 m) and 1350 yards (1230 m) of open roads were avoided during the rutting and hunting seasons, respectively. Elk consistently avoided areas within 0.5 mile (800 m) of active logging and road building activities.

Grizzly/Black Bear Interactions and Competition

Project Leader;	C. Jonkel
Student Investigator:	H. Carriles
Cooperators:	U.S. Fish and Wildlife Service; National Park Service; Montana Department of Fish, Wildlife and Parks; U.S. Forest Service; University of Montana

Objectives:

1. Determine similarities and/or differences, if any, of grizzly and black bear food habits from radio-location data and scat analysis.
2. Compare the habitat component preferences of both species:
   a) On an individual home range basis where a grizzly and a black bear overlap.
   b) By differences between species within the study area.
3. Evaluate grizzly and black bear food habits in the context of phenology, productivity, and nutrient content of certain important plant foods.
4. Compare the feeding strategies of both species in areas of range and home range overlap. Identify and investigate temporal and/or spacial separation or exclusion on preferred feeding sites.

Results:

The student investigator took courses during winter and spring quarters at the university. Two flights were taken to locate bear den sites, one each in February and March. Field work began in March with visits to four black bear dens. Two subadult bears were drugged in their den to check the condition of their expandable collars.

The two adult female black bear dens were located and marked. Both bears had cubs--a total of five between them. All bears became active in late April-early May. The subadult male black bear dropped his collar in the den and subsequently abandoned the site. The adult male black bear collared in 1980 has not been located since September 1980 and it is presumed that his collar has malfunctioned. Three female black bears remain collared. One adult male grizzly bear was legally shot by a hunter in British Columbia in May 1981, while a subadult female was collared in B.C. also in May 1981, leaving 10 grizzlies collared.

Intensive radio-tracking began in May. Phenology plots of bear foods were once again monitored beginning in May and will continue until the fall dormancy period. The student investigator will move into the field in early June and remain until the bears den in October-November.

The Food Habits of and Habitat Selection by a Barren Ground Grizzly Female and Cubs, Brooks Range, Alaska

Project Leader:	B. W. O'Gara
Student Investigator:	J. Hechtel
Cooperators:	Alaska Department of Fish and Game, Naval Arctic Research Laboratory, National Wildlife Federation, Wildlife Management Institute, National Audubon Society, Theodore Roosevelt Memorial Fund of the American Museum, Arctic Institute of North America

Objectives:

1. To examine in detail the seasonal food habits of a female grizzly and her two offspring, and to provide a general account of bear food habits on the western North Slope.
2. To determine daily movement and activity patterns, seasonal movements and the home range of the bears.
3. To describe and map portions of habitat within the home range of the family group.
4. To determine the seasonal habitat use patterns of the bears.
5. To conduct qualitative analysis of important bear food items.

Results:

The student investigator is working in Alaska and working on his thesis.

Effects of Subdivisions and Grazing on Grant Creek Wild Ungulates

Project Leader:	B. W. O'Gara
Student Investigator:	D. Weybright
Cooperators:	Montana Fish, Wildlife and Parks Department, The National Wildlife Federation

Objectives:

1. To determine ungulate numbers, concentration areas, and migration routes on a traditional winter range prior to subdevelopment.
2. To determine forage production, utilization and range condition.
3. To document the process of subdevelopment and cattle grazing and make recommendations to minimize the negative impacts.

Results:

Observations of ungulates on the Grant Creek winter range began mid-January as concentrations of white-tailed deer (Odocoileus virginianus) were seen and elk (Cervus elaphus nelsoni) were first observed. Mule deer (O. hemionus hemionus) appeared mid-March. The white-tailed deer reduced their concentrations by late April, mule deer by late May, and the elk left the area entirely by late June. During this period, 397 white-tailed deer, 421 elk, and 622 mule deer locations were recorded. The maximum group sizes were 27, 35, and 61, respectively.

White-tailed deer were trapped on 9 occasions during February and March. These animals were baited with a combination of alfalfa hay, barley and molasses, apples, and salt. Six elk were trapped and radio-collared in April using salt and anise oil as bait. A mule deer was trapped on 5 June with the same bait.

To date, 186 elk and 2 mule deer radio locations have been recorded, the elk and mule deer are presently enroute to summer range.

Ecology of the Bobcat in a Coniferous Forest Environment

Project Leader:	I. J. Ball
Student Investigator:	D. Smith
Cooperator:	Montana Department of Fish, Wildlife and Parks

Objectives:

1. Describe overall status of western Montana bobcat populations and evaluate their structure and dynamics.
2. Characterize habitat requirements, home range, and general movements.
3. Delineate reproductive processes and relate them to the state of overall population.
4. Evaluate food preferences by stomach analyses and scats.
5. Suggest management options based on the results of this study which could improve management of bobcats.

Results:

Randy Olson had captured 1 bobcat and 2 lynx before his tragic death (see personnel notes). An additional bobcat was trapped and radio marked near Thompson Falls. Preliminary habitat work has continued, and Drew Smith will re-initiate full time work on the project on 1 July.

The Pathology and Cross-infectivity of Sarcocystis in mule deer, white-tailed deer, and elk

Project Leader: B. W. O'Gara
Student Investigator: D. B. Pond
Cooperator: National Bison Range

Objectives:

1. Examine the developement and histopathology of Sarcocystis infections in mule deer.
2. Determine if Sarcocystis from white-tailed deer and elk can be passed through coyotes and infect mule deer.

Results:

One of 6 fetal mule deer from 3 does collected on the National Bison Range was found to be infected with Sarcocystis. All 3 does were grossly infected. More in depth tissue studies on these fawns is continuing.

Twelve mule deer fawns, 1-7 days old, have been obtained for cross infectivity studies this summer.

Morphological Variation Among Bobcat Populations in the Northwestern United States

Project Leader: I. J. Ball
Student Investigator: S. Albert
Cooperators: NRA (tentative)

Objectives:

1. Clarify morphological affinities of bobcats from the northwestern United States with respect to cranial characters:
    a. identify geographical differences in distinct subspecific populations of bobcats based on craniometric characters.
    b. examine sexually dimorphic properties of bobcats among and within several distinct populations.
2. Describe taxonomic affinities and phylogenetic relationship of bobcat populations.
3. Identify craniometric criteria for the differentiation of bobcats and lynx (Lynx canadensis) groups from the northwestern U.S.

Results:

The student investigator has nearly completed the first draft of his Thesis. The abstract will appear in the next Biannual.

Characteristics of a Hunted Mountain Lion Population (*Felis concolor*) in Western Montana

Project Leaders:	B.W. O'Gara and K.G. Greer
Student Investigator:	Kerry M. Murphy
Cooperators:	Montana Department of Fish, Wildlife, and Parks; National Rifle Association; U.S. Forest Service

Objectives:

1. To examine age structure, density, natality, and the distribution of mountain lions in hunted and unhunted drainages of the study area.
2. To investigate hunting pressure and harvest of mountain lions in the study area, and relate those data to population characteristics.
3. To determine timing and distance of dispersal by young animals and the age of sexual maturity in males.
4. To identify and describe winter habitat requirements of mountain lions in the study area, specifically those relating to the aquisition of prey.

Results:

Storms provided 54 days with continuous snow cover during which the student checked approximately 1,350 miles of roads and trails and located lion tracks on 36 occasions. At least 10 adult females, 4 adult males, and 13 kittens were identified in the study area between 1 December 1979 and 31 March 1981. Fourteen lions were treed on 19 occasions; 3 males and 5 females were instrumented with radio-transmitting collars. Appropriate measurements and determinations were made on anesthetized lions. Home range, distribution, and movement data were obtained from more than 140 radio-relocations of collared individuals.

Lion hunters who visited the study area during the 1979-80 hunting season were contacted by telephone. Eighteen tag holders spent at least 34 days hunting the area, treed lions on 9 occasions, and killed 2 males (1 instrumented) and 1 female. Hunters traveled mostly in 4-wheel drive trucks on roads in the main drainage bottoms. Reduced visitation was observed during the 1980-81 season because of unusually light snowfall and a probable reaction to the investigator's presence. Only 3 hunters visited the study area, hunted 2 days, and treed no lions.

Studies of growth and movement patterns displayed by male lions of different ages were continued through recapture and radio-tracking. Two mature adults were instrumented; 1 was killed by a hunter shortly after capture. Another young radio-tagged male has been followed since January 1980. Thirteen kittens of various ages were identified in the area. Seven were known to accompany radio-tagged females, although 2 dispersed before the student could locate and instrument them. He hopes to capture the remaining 5 before the next winter season.

Radio-relocation and snow tracking data were recorded on topographic maps for future analysis. Seven lion kills were identified and described. An analysis of lion habitat use and preference, incorporating ungulate densities and distributions, will be completed after data collection terminates about June 1982.

Summer Range Ecology of White-tailed Deer in the Coniferous Forests of Northwestern Montana

Project Leader:	B. W. O'Gara
Student Investigator:	Rosemary Leach
Cooperator:	Montana Fish, Wildlife and Parks Department

Objectives:

The primary objective of this study is to determine basic summer habitat use by white-tailed deer in the Swan Drainage. Secondarily, to evaluate the possible influences of fire and logging on summer habitat.

Results:

Preliminary findings from relocations of 10 radio-equipped deer indicate deer summer throughout the Swan Valley at low to mid elevations. Summer ranges are small areas of approximately 130 acres. They are composed of small activity centers near riparian habitat, and comparatively larger foraging areas in upland habitat. The timbered areas are very diverse with respect to habitat types.

Eight additional deer were captured and fitted with transmitters during winter 1981. The bulk of the summer's tracking time will be used to delineate home ranges for these new deer. In addition, the student investigator will continue to relocate the previously collared deer. Thus, 18 summer home ranges will be delineated.

The remainder of the summer field season will be devoted to habitat typing and mapping of the home ranges. Cover types, percents canopy coverage, topographic features, and successional stages will be determined in the field. Forest Service and Burlington Northern records will provide fire and logging history on the home ranges.

Seasonal Habitat Selection, Movements and Home Range Size of Bobcats (*Lynx rufus*) in Northcentral Montana

Project Leader:	B. W. O'Gara
Student Investigator:	P. R. Knowles
Cooperators:	Charles M. Russell National Wildlife Refuge

Objectives:

1. To determine home range size and spatial arrangements of bobcats on the study area;
2. to determine seasonal habitat selection and movements of bobcats on the study area; and

3. to provide recommendations for management guidelines to the Charles M. Russell National Wildlife Refuge and the Montana Department of Fish, Wildlife and Parks.

Results:

The student investigator is working on her thesis. The abstract will appear in the next Biannual.

A Study of an Introduced Mountain Sheep Herd near Paradise, Montana

Project Leader:	J. Harris
Student Investigator:	L. Kopec
Cooperators:	U.S. Forest Service; Montana Fish, Wildlife, and Parks Department

Objectives:

1. Locate and map seasonal ranges and movements.
2. Census the herd.
3. Assess productivity.
4. Compare general health and vigor to the Wildhorse Island herd.
5. Make management recommendations regarding possible habitat manipulation and future harvest.

Results:

The student investigator completed his thesis. The abstract follows:

A herd of Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*) was transplanted from Wildhorse Island to the Cutoff area near Paradise, Montana in January 1979. Six of the 41 sheep were radio-collared, and several others were marked with rope collars or neck bands. Six sheep immigrated to the Cutoff area from a nearby herd, and 5 more rams were transplanted to the area in February 1981. The population was estimated at 70 during winter 1980-81. The ewe:lamb ratio was 100:42 at the end of winter 1980-81. Reasons for the apparently low productivity were discussed. Group sizes were lowest during May (4.1) and highest in June (11.7). The lambing season was from early May to early June. Daily movements averaged 0.6 km for ewes and 1.0 km for the radioed ram. Ewe daily movements were relatively constant through the year. The ram showed distinct seasonal variations, moving 1.6 km per day during the rut and 0.3 km per day in winter. Home ranges averaged 541 ha for the ewes and 798 ha for the ram. Ewe home ranges were the smallest during lambing (47 ha) and largest during fall (273 ha). The ram's home range was 21 ha in winter and 305 ha in spring. Ewe standard diameters were lowest during lambing (1.8 km), and

the ram's standard diameter was lowest in winter (1.7 km). Both sexes ranged farthest during the rut, when the standard diameters were 5.0 for the ram and 3.1 for the ewes. Selection for cover types, habitat types, visibility classes, and various slope, aspect, and elevation categories was tested. Approximately 85% of all groups observed were within 45 m of escape cover, and 98% were within 135 m. *Protostrongylus* spp. larvae were present in feces at an average level of 1.7 larvae per gram. The pattern of range recolonization and dispersal was discussed. Management recommendations were made.

Ecology and Management of the River Otter in Southwestern Montana.

Project Leader:	B. W. O'Gara
Student Investigator:	H. Zackheim
Cooperators:	Montana Department of Fish, Wildlife, and Parks; National Wildlife Federation.

Objectives:

1. To develop a technique to survey river otter populations.
2. To determine relative densities of otters on area rivers.
3. To identify characteristics of otter habitat.
4. To assess the impacts of harvest on otter populations.

Results:

During the winter, the investigator walked approximately 250 kilometers of riverbank and recorded the amount of otter sign (scats and tracks), the location of major latrine sites and habitat characteristics. Otter sign density was greatest along the middle Big Hole River, followed, in decreasing order, by the lower Gallatin, upper Jefferson, lower Beaverhead, upper Madison, lower Big Hole, lower Madison and Ruby Rivers.

Eight sections on five rivers were selected for bi-weekly surveys of otter sign. The surveys began in March and will continue through Fall. Preliminary results confirm that otters consistently use established latrine sites, so the amount of sign can serve as an index of the relative use of river habitats by otters.

Monitoring was continued of the movements and habitat selection of one adult male otter previously equipped with an intraperitoneal radio transmitter. The otter was relocated 15 times and had moved a total of 27 km from his release site on the Jefferson River near Twin Bridges to the Big Hole River near Glen. Denning sites consisted of beaver lodges and burrows under bank vegetation.

Scat analysis, compilation of responses to a questionnaire on otter trapping, and investigation of a scent-post technique for censusing otters will continue through summer.

Habitat Selection and Use, Movements, and Home Range of Malaysian Seladang (*Bos gaurus hubbacki*) on a Disturbed Range in Central Pahang, Malaysia

Project Leader:	B. W. O'Gara
Student Investigator:	P. Conry
Cooperators:	Department of Wildlife and National Parks Malaysia, Smithsonian-Peace Corps Environmental Program, U.S. Peace Corps Malaysia

Objectives:

1. To develop chemical capture techniques and establish guidelines for drug dosages.
2. To describe seladang habitat use and selection, movements, and home range in the Lepar River study area.
3. To describe seladang food habits.
4. To investigate seladang interactions with man, including;
    a) impacts of agricultural development and associated disturbance,
    b) impacts of logging activities and associated distrubance,
    c) response to habitat management projects.
5. To suggest guidelines for management of seladang in disturbed habitats.

Results:

The student investigator has completed the first draft of his Thesis. The abstract should appear in the next Biannual.

Ecology of Sage Grouse on the INEL Site

Project Leader:	I. J. Ball
Student Investigator:	J. Connelly
Cooperators:	U.S. Department of Energy, Idaho National Engineering Lab; Idaho Department of Fish and Game.

Objectives:

1. Quantify the number of sage grouse on the 900 mi^2 INEL Site throughout the year.
2. Determine the primary or "key use" area of both resident and migrant sage grouse on the INEL Site.
3. Determine migration routes and summer locations of sage grouse wintering on the INEL Site.
4. Determine radionuclide concentrations in grouse on the INEL Site and determine, in particular, the movements of grouse utilizing areas known to contain "above background" concentrations of radionuclides.
5. Describe the sage grouse wintering areas (in particular the vegetation) on and near the INEL Site.

Results:

Final field work (spring lek surveys) were completed in April, and 2 of 3 papers that will comprise the dissertation are essentially complete. Estimated completion date is September 1981.

Movements and Ecology of Bald Eagles Associated with Autumn Concentrations in Glacier National Park, Montana

Project Leader:	B. R. McClelland
Research Associates:	H. L. Allen, J. G. Crenshaw, P. T. McClelland
Student Investigator:	L. S. Young
Cooperators:	Alberta Fish and Wildlife Division; USDI, National Park Service, Glacier National Park; National Audubon Society; Montana Forest and Conservation Experiment Station; Wildlife Management Institute and American Petroleum Institute; USDI, Fish and Wildlife Service, Office of Endangered Species; University of Montana, School of Forestry; Sigma Xi; USDI, Water and Power Resources Service (Casper, WY; Denver, CO); Colorado Division of Wildlife Grand Junction; USDI, Bureau of Land Management (Salt Lake City, UT; Vernal, UT; Elko, NV; Boise, ID); Parks Canada, Wood Buffalo National Park; Idaho Department of Fish and Game.

Objectives:

1. To determine migration routes, wintering areas, and summer ranges of bald eagles associated with autumn concentrations in Glacier National Park, Montana.
2. To study local movements and ecology of this group of eagles throughout the course of seasonal movements.
3. To study spatial and temporal relationships among bald eagles, habitats, and specific habitat components through analysis of local and long-range movements and local ecology, and to identify habitats essential to this group of eagles.
4. To develop and present guidelines for coordinated, regional management of habitats used by transient bald eagles throughout western North America, and to provide specific recommendations for management of essential habitats identified.

Results:

Long-range tracking of transmitter-equipped eagles continued. Intensive study of local movements and ecology at wintering areas so identified was conducted at Swan Valley/Ovando Valley, MT (1 adult, 1 subadult); Salmon River near Challis, ID (1 SA); Snake River headwaters and adjacent drainages, ID, WY, UT (1 A, 2 SA); American Falls Reservoir, ID (1 A, 1 SA); Rush Valley, UT (1 A, 1 SA); Mud Lake, NV

(1 SA); Klamath Basin, OR/CA (1 A); and Snake River near Ontario, OR (1 SA). Additional sightings of color marked eagles were made in several of these areas. The subadult wintering near Ontario, Or was shot and killed during January 1981. A suspect was apprehended by U.S. Fish and Wildlife Service agents, and the case is currently being prosecuted.

With the approach of spring, the tracking effort was shifted primarily to adult eagles. The adult wintering in the Klamath Basin was the first to initiate northward movement, in mid-March. Other adults started north during late March to early April. All adults migrated back through Montana along the Continental Divide, crossing the Divide at varying latitudes in western Montana. All eagles were on the east side of the Divide prior to moving north across the prairie in southwestern Alberta. During northward tracking, 2 adults that had been missing were relocated, and by late April, all 6 of the adults captured and equipped with transmitters at Glacier National Park during autumn 1980 were in the Northwest Territories (5) or extreme northern Alberta (1). On the last series of flights, in early May, 4 of the 6 were at locations that presumably represent summer ranges (Great Slave Lake, NWT (1); Taltson River system, NWT (2); Lake Claire, AB (1)) while 2 had continued sufficiently far north (probable vicinity Great Bear Lake, NWT) that further flying was impossible with existing resources. Three of the 4 stationary eagles were paired and in suitable nesting habitat. Of the remaining 2, one was definitely paired and the status of the other undetermined at time of last contact. None of the subadults were located during the spring flights in Canada, suggesting that the subadults, without the stimulus of a reproductive committment, move north substantially later than do adults.

If funds become available, additional flights will be conducted during summer 1981 to relocate the 2 extreme northern adults, ascertain breeding status and productivity of all adults, and attempt to relocate subadults.

A Comparison of Feeding and Nesting Habitat Use by Woodpeckers in First and Second Year Burns

Project Leaders:	B. R. McClelland, J. H. Lowe
Student Investigator:	M. Harris
Cooperators:	McIntire-Stennis, University of Montana School of Forestry, Champion International

Objectives:

1. To compare woodpecker population densities within and adjacent to the burns.
2. To identify bark- and wood-inhabiting insect species and their distributions within the study areas.
3. To characterize woodpecker foraging habits within the burns.
4. To characterize woodpecker nest sites within and near the burns.
5. To propose management guidelines for post-fire logging which would maintain suitable habitat for woodpeckers and associated cavity nesters.

Results:

Three species of woodpeckers, the Hairy (*Picoides villosus*), Northern Three-toed (*P. tridactylus*), and Black-backed Three-toed (*P. arcticus*) were observed during the breeding seasons of 1979 and 1980. The first year's observations were made in a 2-year post-fire burn of 1,200 acres. During 1980, the study was continued in a 1-year post-fire burn of 300 acres. Currently, work is continuing in the 300 acre site.

During 1979, woodpecker densities within and adjacent to the burn were 1.3 and 0.09 individuals per acre, respectively, In 1980, woodpecker densities in the 1-year burn site were approximately 0.4 individuals per acre. Returning during the spring of 1980 to the previous year's study site, which by this time was 3-years post-fire, woodpecker densities were estimated to have dropped to 0.16 individuals per acre. Transects are being run to determine woodpecker densities on both sides for 1981.

Significant differences ($p < 0.05$) in tree species selection for foraging were found between all 3 woodpeckers species the first spring and between *P. villosus* and *P. arcticus* the second spring. A significant difference in foraging heights was observed only between *P. villosus* and *P. arcticus* the second year. All 3 species the first year and *P. villosus* and *P. arcticus* the second year selected trees of significantly different size classes.

During March and April, 1981, 72 log sections cut the previous spring on the 300 acre site, brought into the lab and sealed in screening, were each stripped of bark and carefully examined for insect activity. Adult wood-inhabiting insects that emerged from the sections were identified to family.

Currently, results of the insect rearing study are being recorded. These data along with the woodpecker nesting and foraging data will be compared to estimates of habitat availability to determine possible insect and woodpecker preferences, and subsequently relate the 2.

Cabinet Mountains Grizzly Bear Study

Project Leaders:	C. Jonkel and B.W. O'Gara
Field Research Leader:	T. Thier
Field Assistants:	D. Jandreau, M. Mantas, S. Mack, J. Almack, B. Anderson, and M. Madel
Cooperators:	U.S. Forest Service, Border Grizzly Project (U. of M.), Montana Department of Fish, Wildlife and Parks, and U.S. Fish and Wildlife Service

Objectives:

1. Capture, mark, and radio-track resident grizzlies and gather base-line information in reference to their habitat utilization and general ecology.
2. Document, evaluate, and map habitat components present within the area.

3. Collect and evaluate reports of grizzly observations by local residents.
4. Document impacts on grizzly habitat by various human activities.
5. Identify and map critical sites such as spring ranges, denning areas, etc.

Results:

A final report was sent to all cooperators.

Population Fluctuations and Distribution Patterns of Mallards in the Pacific Northwest

Project Leader:	I. J. Ball
Student Investigators:	Michael J. Rabenberg and Lois Regen
Cooperators:	U.S. Fish and Wildlife Service, Refuge Division, Portland; Battelle Pacific Northwest Laboratories.

Objectives:

1. Document factors influencing the number of mallards wintering in the Columbia Basin.
2. Document timing, duration, and distance of mallard feeding flights.
3. Investigate interchange of birds between major resting areas.
4. Determine food and field-type preferences of wintering mallards.
5. Document any changes in average physical condition of mallards.
6. Study the dynamics of flock composition, flock sizes, sex ratios, and pair status over time and between areas.
7. Analyze band recovery data from mallards banded in the Pacific Northwest.

Results:

Data analysis is about 80% complete and approximately 1/2 of the thesis has been written and edited. Rabenberg is currently working at Northern Prairie Wildlife Research Center. Completion of the thesis and overall project report will be delayed until September 1981.

Black Bear Ecology and Management in the Northern Conifer-Hardwood Forests of Maine

Project Leaders:	C. Jonkel and L. Pengelly
Student Investigator:	R. Hugie
Cooperators:	Maine Department of Inland Fisheries and Wildlife, University of Montana, University of Maine, National Rifle Association, Penobscot Valley Conservation Association, Border Grizzly Project.

Objectives:

1. To determine black bear habitat and its use by bears in Maine.
    a. Describe available habitat in terms of cover types, topography, current use, and road networks.
    b. Describe bear distribution and movements in available habitat.
    c. Describe patterns of black bear behavior such as seasonal activity, sex and age similarities in movements, and how bears relate to human activity within their range.
2. To describe how black bear habitat can be perpetuated.
    a. Describe the effects of forest practices, fire, and other activities on bear habitat.
3. To describe the basic biological characteristics of black bears on the study area.

Results:

The student investigator turned in a rough draft of his dissertation. The summary should appear in the next Biannual Report.

Reproductive Ecology and Habitat Utilization by Richardson's Merlins in Southeastern Montana

Project Leader:	I. J. Ball
Student Investigator:	D. M. Becker
Cooperators:	USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Custer National Forest

Objectives:

1. To locate active nests and describe habitat utilization by quantifying features of nesting and hunting habitat.
2. To determine reproductive success and possible effects of various chemical pollutants on reproduction.
3. To determine timing and duration of nesting activities.
4. To determine prey utilization.
5. To recommend management actions for Merlins and their habitat on the study areas.

Results:

The student investigator was in the field from 18 May until 15 August, 1980. Three breeding male Merlins were captured and instrumented with radio transmitters. Their movements were studied from 15 June to 20 July. Features of nesting habitat were quantified at 33 locations. Vegetative features at 4 regularly-used hunting locations were quantified. Reproductive performance at 15 nests was documented by 3 visits to each during the nesting season. Observations on timing and duration of various nesting activities provided a documentation of nesting chronology. During the course of the study, 173 prey items were collected and identified. An annual progress report was completed and submitted to cooperators.

Field work in 1981 will commence on 10 June and continue through 15 August. Data collection will proceed as described above.

Productivity, Nest Site Characteristics, and Food Habits of Long-eared Owls in the Snake River Birds of Prey Study Area

Project Leader:	B. R. McClelland
Student Investigator:	J. S. Marks
Cooperators:	USDI, Bureau of Land Management, Snake River Birds of Prey Research Project; New Jersey Raptor Association

Objectives:

1. To determine the nesting density and annual productivity of Long-eared Owls in the BPSA.
2. To determine the influence of nest site characteristics on the nesting success of Long-eared Owls.
3. To determine the food habits of nesting Long-eared Owls.

Results:

Sixty-four breeding pairs of Long-eared Owls (*Asio otus*) were located in the Snake River Birds of Prey Study Area (BPSA) in 1980. At least 3 of these pairs renested, making a total of 67 nesting attempts. In each of 66 attempts, eggs were laid in the abandoned nest of a Black-billed Magpie (*Pica pica*) or a Common Crow (*Corvus brachyrhynchos*). One nest was in a natural cavity in an oolitic limestone cliff. In 1980, the student investigator banded 113 young Long-eared Owls, 8 of which were subsequently found dead in or near their nests. Eighty-four owls were known to have survived to fledging age. At least 37 pairs of owls (57.8%) failed to raise any young to fledging age.

At present, the nesting season is in progress and 40 breeding pairs have been located in or near the BPSA. One adult and 91 young Long-eared Owls have been banded. Three Breeding males have been captured at their nest sites; all 3 were banded as nestlings in 1980 and are currently breeding less than 1 km from their natal nests.

Analysis of data collected on nest site characteristics is not complete. Preliminary observations suggest that Long-eared Owl nest height, as well as procimity of the nest to water, roads, corvid nests, and Great Horned Owl (Bubo virginianus) nests, are variables that may influence nesting success.

Long-eared Owls feed primarily on small rodents. Four species (Dipodomys ordi, Perognathus parvus, Peromyscus sp., Microtus montanus) comprised almost 90% of the 3,500 prey items thus far identified.

Field work will be completed in July of 1981 and a thesis should be completed in the spring of 1982.

Habitat selection, breeding biology, and density of the mountain plover on the Charles M. Russell National Wildlife Refuge.

Project Leader:	J. Ball
Student Investigator:	S. Olson
Cooperators:	Charles M. Russell NWR; Chapman Fund; Sigma Xi; Five Valley Chapter of the Wildlife Society (tentative).

Objectives:

1. Establish the degree to which breeding mountain plovers on CMR are dependent on prairie dog towns.
2. Determine the density of plovers on prairie dog towns and the proportion of towns occupied.
3. Determine nest success and fledging success.
4. Document and compare densities of insect food for plovers on and off prairie dog towns.
5. Record general behavior, with special emphasis on polyandry and multiple clutches.

Results:

Partial funding has been secured, and the student investigator initiated the first field season.

Moose-habitat relationships in the Yaak Country, Northwestern Montana.

Project Leaders:	L. Metzgar and J. Ball
Student Investigator:	R. Matchett
Cooperators:	U.S. Forest Service, Forest and Range Experiment Station, Kootenai National Forest, and Montana Dept. of Fish, Wildlife and Parks.

Objectives (tentative):

1. Document seasonal habitat selection by moose in representative portions of the Yaak country.
2. Assess the impacts of logging on moose habitats, populations and behavior.

3. Describe seasonal movement patterns of moose.
4. Develop guidelines for logging that will optimize benefits and minimize disturbance to moose.

Results:

Funding has been secured and the study design is being developed in cooperation with FS and FWP personnel.

The Value of Riparian Habitats to Land Birds and the Effects of Livestock Grazing on avian Community Structure

Project Leader:	R. Hutto
Student Investigator:	S. Mosconi
Field Assistants:	J. Marsluff, S. Hicks, K. Turko
Cooperators:	U.S. Fish and Wildlife Service, Denver Wildlife Research Center

Objectives:

1. Compare land bird use of riparian habitats and other forest habitats in western Montana.
2. Evaluate the effects of livestock grazing on riparian vegetation and avian community structure.

Results:

The student investigator has completed field work and is analyzing data and writing her thesis.

Similarity indices are calculated from bird census results in 4 riparian and 3 upland forest sites during all seasons. The highest similarity value calculated is between the low elevation grazed riparian (LEGR) site and the low elevation ungrazed riparian (LEUR) site during summer (0.82). The second highest similarity value calculated is between the high elevation grazed riparian (HEGR) site and the high elevation ungrazed riparian (HEUR) site, also during summer (0.77). Between winter and summer, the riparian sites have lower similarities than the upland sites, possibly reflecting the presence of more migrants relative to residents in the riparian sites compared to the upland sites. Although some small sample sizes of the spring and fall data make comparison unreliable, the 3 upland sites are generally more similar to the high elevation riparian sites than to the low elevation ones.

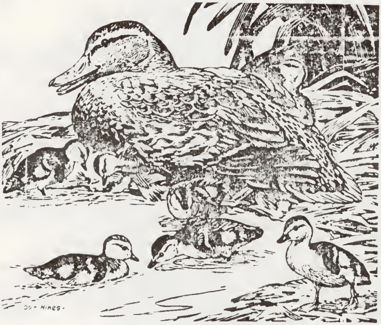
Data from the LEGR and LEUR sites are being analyzed to establish satisfactory methodology before analyzing data from HEGR and HEUR sites. Partial results from the LEGR and LEUR sites will be published in the Wildlife-Livestock Relationships Symposium proceedings. Some of these results follow.

Numbers of bird species and total densities are similar between LEGR and LEUR sites; however, 7 species have significantly higher densities on the LEGR site and 11 species have significantly higher densities on the LEUR site.

The LEGR and LEUR sites are similar in vegetative species composition, but dissimilar in structure. These differences are quantified along 16 habitat variables measured in at least 50 plots in each site. The average value for each variable is an estimate of what is available on each site. Seven of these variables differ significantly between sites and can be attributed to the effects of livestock grazing.

The same 16 habitat variables are quantified at foraging and nesting locations of several common bird species. Differences in bird species' densities may be related to the effect of grazing on vegetative structure altering foraging or nesting locations. If so, changes in vegetation may be used to predict changes in bird species' densities.

Preliminary trials using discriminant function analysis to make these predictions indicate some predictive capability. In the LEUR site, habitat variables measured in foraging locations correctly identified bird species in the thrush guild for 80.7% of the observations; in the flycatcher guild for 76.9% of the observations; in the warbler guild for 71.6% of the observations; and in the vireo guild for 69.2% of the observations. Guild groupings were used to make analysis more manageable and because they are probably biologically more meaningful. Based on foraging data from the LEUR site, the random plots from either the LEUR or the LEGR site are classified as being most suitable as a foraging site for a species within that guild with about 70-80% accuracy. These predictions are compared to actual results of censuses. Predicted and observed species composition by guilds matched closely for flycatchers, but less well for other guilds (x^2; p=.05). The method appears to be sensitive to including or dropping species with small sample size, and guidelines toward solving this problem are being developed.



CONSERVATION, EDUCATION, AND PUBLIC RELATIONS

B. W. O'Gara

5 January	Attended Western Section, Montana Chapter of The Wildlife Society meeting on Riparian Habitats.
6 January	Attended a meeting with National Wildlife Federation personnel.
20 January	Presented a lecture on wildlife management in Eurasia to Mammalian Conservation (For. 475) - 40 students.
26 January	Met with personnel of the National Park Service and the Flathead River Basin Study Commission, discussing possible Unit involvement in studies along the Flathead River.
2 February	Met with county agent and members of concerned citizens groups (Audubon, National Wildlife Federation, Defenders of Wildlife) to discuss research on 1080 control of ground squirrel populations.
6 February	Conferred with DWRC personnel by telephone concerning ground squirrel research.
10 February	Attended a 1080 oversight meeting in Helena.
12 February	Prepared a summary of female and minority graduate students at the Unit for the Forest Service.
17 February	Presented a lecture on pronghorns to Mammal Conservation and Management (For. 474) - 50 students.
23 February	Presented a lecture on Asian and African parks to Parks Management (For. 483) - 50 students.
25 February	Attended a rodent control council meeting in Missoula.
4 March	Presented a lecture on Game Ranching to Principles of Wildlife Conservation Class (For. 370) - 30 students.
4 March	Reviewed an 18 page M.S. on genetic variation in pronghorns for a University of New Mexico professor.
9 March	Gave a slide presentation on problems associated with predator and rodent control to the Five Valley Chapter of the Audubon Society.
23 March	Provided information to the U. of M. Law School on eagle predation problems in Montana.

24 March	Participated in a 1080 oversight committee meeting in Helena, Montana, and presented research proposals on investigations of reinvasion by ground squirrels after poisoning and break down of 1080 in squirrel carcasses. Both were approved and funded by the Montana Department of Agriculture and the Missoula County Rodent Control Board.
10 April	Took Japanese and British visitors on a tour of The National Bison Range.
11-12 April	Served as a judge at the UM Wildlife Film Festival.
17 April	Met with UM Research Oversight Committee.
20-22 April	Presented the following papers at the Livestock-Wildlife Symposium, Coeur d'Alene, Idaho: McNay, M. E. and B. W. O'Gara (on leave). Spatial distribution and diet overlap of cattle and pronghorns during the fawning season in northwestern Nevada. O'Gara, B. W. (on leave). Predation by golden eagles on domestic lambs in Montana.
27 April	Presented a lecture on domestic sheep/eagle and coyote and antelope/predator studies to Mammalian Predators (Wildl. Biol. 395) - 30 students.
31 April	(on leave) presented a lecture to Alberta Provincial Game Wardens and damage control agents on identification of predator kills by killing and feeding patterns at Blue Lake Centre, Alberta.
3 May	Reviewed a 24 page ms. for the Idaho Wildlife/Livestock Interactions Symposium and the 19 page Sonoran Pronghorn recovery plan for the OCU.
4 May	Attended a public meeting at the Missoula County Courthouse concerning 1080 poisoning of Columbian ground squirrels and answered questions concerning on-going research, poisoning of non target species, etc.
6 May	Participated in advisory committee meeting on mission oriented research in second growth forests.
7 May	Reviewed a 21 page ms on Foraging economy and group size in mammalian herbivores for Science.
8 May	Lectured to Fors 370, Principles of Wildlife Conservation class, on game ranching (82 undergraduate students).
13 May	Spent all day at Savanach Ranger Station giving slide lectures, showing research techniques, and answering questions for 36 5th and 6th graders from area schools.

16 May	Reviewed a 29 page manuscript for the Northeast Fish and Wildlife Contenence, and a 66 page ms for the Border Grizzly Project.
18 May	Lectured for 2 hours on predator studies to Fors. 600, Mammalian Predator Symposium, (30 grad. students).
19 May	Met with a Missoulian reporter preparing an article on 1080 at the request of the Missoula County Agent.
27 May	Attended the Spring Coordinating Committee Meeting held in Helena, Montana.
2 June	Lectured on Forensic Science for wildlife law enforcement to Fors. 301, Wildlife Law Enforcement (40 undergrad. students).
8 June	Conducted honors exam for graduating senior.
11 June	Reviewed a 20 page ms for the Wolf Ecology Project.
16 June	Participated in a meeting of the Montana Wildl. Fed. Land Management Committee.

I. J. Ball

5 January	Attended Western Section, Montana Chapter of the Wildlife Society meeting on Riparian Habitats.
26 January	Met with personnel of the National Park Service and the Flathead River Basin Study Commission, discussing possible Unit involvement in studies along the Flathead River.
2 February	Met with county agent and members of concerned citizens groups (Audubon, National Wildlife Federation, Defenders of Wildlife) to discuss research on 1080 control of ground squirrel populations.
9 February	Presented a lecture on small game population biology and management to Principles of Wildlife Conservation (W. Bio. 370) - 30 students.
19 February	Presented a lecture on waterfowl management to Bird Conservation and Management (For. 473) - 50 students.
22-26 March	Supervised and partially taught a continuing education course for wildlife biologist on Biology and Management of wildlife populations at U of M - attended by 30 biologists from state, federal, and provincial biologists.
23 March	Reviewed a 15 page manuscript for the J. Wildl. Manage.

23-24 April	Presented the following paper at the Northwest Section Meeting, TWS, Coeur d'Alene, Idaho: Ball, I. J. (on leave), E.L. Bowhay, and C.F. Yocom. Western Canada geese in Washington
13 May	Gave a lecture to 20 graduate and undergraduate wildlife students at MSU, Bozeman, on The African black duck.
15 May	Lectured on goose management to Fors. 370 class (82 undergraduate students).
19 May	Met with Forest Service and Montana Fish, Wildlife and Parks biologists in Libby, Montana, to organize a moose research project.
27-28 May	Participated in an IRP meeting at the Area Office in Billings.
10 June	Reviewed a 14 page ms for J. Wildl. Manage.

S. W. Albert

23-24 April	Presented the following paper at the Northwest Section Meeting, TWS, Coeur d'Alene, Idaho: Albert, S. W. Efficacy and costs of four rodenticides for controlling Columbian ground squirrels in Western Montana.

G. Burnett

	Teaching assistant, Zoology Department.
23-24 April	Presented the following paper at the Northwest Section Meeting, TWS, Coeur d'Alene, Idaho: Burnett, G. Movements and Activity Patterns of marten in Montana. Attended numerous sessions.

J. W. Connelly

16 April	Presented the following paper at the Snake River Chapter of the Audubon Society Meeting: Connelly, J. W. 1981. The life history and habitat requirements of sage grouse in southeastern Idaho.

P. Hampton

	Participated in and advised on the filming of a movie on Trumpeter Swans, produced by Survival Anglia, and scheduled to be aired by the British Broadcasting Company in 92 countries next year.
	Attended the annual Trumpeter Swan Society meeting in Victoria, B.C. and presented two papers.

M. Harris

12 January	Presented a talk to 5-Valleys Audubon Club on my woodpecker research in pest-fire habitat
22 January	Guest speaker at Wildlife Club meeting
13 April	Discussed my woodpecker and insect research with Ned Kelly of the BBC.
23-24 April	Attended the Northwest Section Meetings of the TWS, Coeur d'Alene, Idaho

D. A. Jenni

20-22 April	Wildlife-livestock Symposium sponsored by the Univ. of Id and the USFS in Coeur d'Alene, Idaho, and presented the following paper: "Effects of Grazing on Long-billed Curlew (*Numenius americanns*) Breeding Behavior and Ecology in Southwestern Idaho." (with Tom Bicak)

D. Kautz

27 March	Presented paper titled "Flora of Wild Horse Island, Flathead Lake, Montana" at the Northwest Scientific Association annual meeting, Corvallis, Oregon

C. J. Knowles

20-22 April	Presented the following paper at the Livestock-Wildlife Symposium, Coeur d'Alene, Idaho: Knowles, C. J. and R. B. Campbell. Distribution of elk and cattle in a rest-rotation grazing system.

P. R. Knowles

	Gave a lecture on bobcats at the Community College in Ronan.
	Gave a lecture on bobcats to Wildl. Biol. 170

20-22 April Attended the Wildlife-Livestock Symposium

23-24 April Attended the NW Section of the Wildlife Society and presented a paper.

Habitat Selection by bobcats in the Missouri River Breaks, MT.

R. Leach

23-24 April Attended the Northwest Section, TWS, Coeur d'Alene, Idaho.

J. Malloy

23-24 April Attended the annual meeting of the Northwest Section of the Wildlife Society in Coeur d'Alene, Idaho.

J. O. Meeker

20-22 April Attended and presented a paper at the Wildlife-Livestock Relationships Symposium, Coeur d'Alene, Idaho:

Meeker, J. O. In eractions between pronghorn antelope and feral horses in northwestern Nevada.

S. Mosconi

20-22 April Attended the Wildlife-Livestock Relationships Symposium in Coeur d'Alene, Idaho.

C. Servheen

Teaching Assistant in Mammalogy and Big Game Conservation Taught Wildlife Biology 395 Sec 2 - Mammalian Predators of Montana and Wildlife Biology 395 Sec 3 - Ecology and Behavior of Raptorial Birds.

20-22 April Attended NW Section Wildlife Society, Coeur d'Alene, Idaho and presented paper in Wildlife-Livestock Symposium.

P. L. Wright

Attended NRA Convention in Denver, CO and participated in Grants-in-Aid Committee Meeting.

H. Carriles

Winter Quarter Gave short talk on Aerial Radiotracking Techniques in For. 571, Wildlife Research Techniques.

11 March	First Annual Research and Resource Management Workshop at Glacier National Park.
20-22 April	Livestock-Wildlife Symposium. Coeur d'Alene Idaho.
23-24 April	N.W. Section Meeting, Wildlife Society, Coeur d'Alene, Idaho.

R. Yeager

Spring Quarter	Teaching Assistant for Botany Department.

H. Zackheim

11 March	Gave presentations on river otter ecology to two science classes at Sentinel High School.

PUBLICATIONS

Connelly, J. W., W. J. Arthur, and O. D. Markham. 1981. Sage grouse leks on recently disturbed sites. J. Range Manage. 34:153-154.

Marks, J. S., J. H. Doremus, and A. R. Bammann. 1980. Black-throated Sparrows breeding in Idaho. Murrelet 61: 112-113.

__________., and E. Yensen. 1980. Nest sites and food habits of Long-eared Owls in southwestern Idaho. Murrelet 61: 86-91.

Hutto, R. L. and S. L. Mosconi. Lateral detectability profiles for line transect bird censuses: some problems and an alternative.

O'Gara, B. W. 1980. Play by the rules and enjoy the Game. Montana Outdoors 11(6):27-33.

Servheen, D., T. Thier, C. Jonkel, and D. Beaty. 1981. An ear-mounted transmitter for bears. Wildl. Soc. Bull. 9:56-57.

Knight, R., G. Allen, M. Stalmaster, and C. Servheen, eds. 1981. Proceedings of the Washington Bald Eagle Symposium. 14-15 June 1980, Seattle Aquarium, Seattle. 254pp.

Claar, J., R. Klaver, and C. Servheen. 1981. Grizzly bear/livestock relationships: A management challenge on the Flathead Indian Reservation. In Proceedings of Wildlife/Livestock Symposium, Coeur d'Alene, Idaho.

Shoesmith, M. W. 1980. Seasonal movements and social behavior of elk on Mirror plateau, Yellowstone National Park. pp. 166-176 in North American Elk: Ecology, Behavior and Management, M.S. Boyce, and Hayden-Wing Eds. The University of Wyoming, Laramie.

Tilton, M. E. and E. E. Willard. 1981. Winter food habits of Mountain sheep in Montana. J. Wildl. Manage. 45(2):548-553.

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BIANNUAL REPORT

of the

MONTANA COOPERATIVE WILDLIFE RESEARCH UNIT

University of Montana

Missoula, Montana

to

UNIVERSITY OF MONTANA

MONTANA FISH, WILDLIFE, AND PARKS COMMISSION

WILDLIFE MANAGEMENT INSTITUTE

U.S. FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR

Vol. 31, No. 1
July-December 1980

Respectfully submitted,

Bart W. O'Gara

Bart W. O'Gara, Leader

Joe Ball

Joe Ball, Ass't Leader

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MONTANA COOPERATIVE WILDLIFE

RESEARCH UNIT PERSONNEL

Coordinating Committee

Eugene O. Allen, Montana Fish, Wildlife, and Parks Department, Helena
W. Leslie Pengelly, University of Montana, Missoula
Bart W. O'Gara, U.S. Fish and Wildlife Service, Missoula

Unit Staff

Bart W. O'Gara, Unit Leader
Joe Ball, Assistant Leader
John J. Craighead, Affiliate in Zoology and Forestry
John T. Harris, Forestry School
Donald A. Jenni, Zoology Department
Charles Jonkel, Forestry School and Montana Fish, Wildlife and Parks Department
Lee H. Metzgar, Zoology Department
W. Leslie Pengelly, Forestry School
Robert R. Ream, Forestry School
Andrew L. Sheldon, Zoology Department
Philip L. Wright, Zoology Department
"Ginger" Schwarz, Unit Secretary

Graduate Students

Steve Albert
Gary Burnett
Harry Carriles
Jack Connelly
Paul Conry
Rod Flynn
Paul Hampton
Mary Harris
John Hechtel
Jack Hogg
Roy Hugie
Darrell Kautz
Craig Knowles
Pam Knowles
Len Kopec
Rosemary Leach
John Lehmkuhl
John Malloy
Mike McDonald
Jo Meeker
Kerry Murphy
Sandra Mosconi
Randy Olson
Daniel Pond
Mike Rabenberg
Chris Servheen
Harrie Sherwood
Tim Thier
Darrel Weybright
Robert Yeager
Leonard Young
Hugh Zackheim

COOPERATING AGENCIES

University of Montana
Montana Fish, Wildlife, and Parks Department
Wildlife Management Institute
U.S. Fish and Wildlife Service

Alaska Fish and Game Department
Arctic Institute of North America
Audubon Society
Border Grizzly Project
Bureau of Indian Affairs
Bureau of Land Management
Champion International
Charles M. Russell National Wildlife Range
Confederated Salish and Kootenai Tribe
Denver Wildlife Research Center
Environmental Research Institute
Flathead National Forest
Harriman State Park
Idaho Cooperative Wildlife Research Unit
Idaho Department of Fish and Game
Idaho National Engineering Laboratory
Malaysia Department of Wildlife and National Parks
McInntire Stennis
Montana Departments of Agriculture and Livestock
Montana Fish, Wildlife and Parks Department (Bozeman Laboratory)
Montana Forest and Conservation Experiment Station
National Bison Range
National Geographic Society
National Rifle Association
National Wildlife Federation
Nature Conservency
Naval Arctic Research Laboratory, University of Alaska
Nevada Department of Fish and Game
Nevada Department of Wildlife
Refuge Division, Portland
Smithsonian - Peace Corps Environmental Program
Targhee National Forest
Theodore Roosevelt Memorial Fund of the American Museum
U.S. Department of Energy
U.S. Forest Service
U.S. National Park Service
U.S. Peace Corps, Malaysia
University of Montana Foundation
University of Montana School of Forestry

Wildlife - Wildlands Institute
World Wildlife Fund International
Wyoming Department of Fish and Game
Yellowstone National Park

PERSONNEL NOTES

Eugene Allen, Chief of Game for the Montana Department of Fish, Wildlife and Parks, joined the Unit Coordinating Committee. Gene served as Chief of research for the Department before becoming Chief of Game so has an excellent grasp of problems related to research in the West. Welcome to the Unit Gene.

RESEARCH PROJECTS

Physiologic and Ecologic Studies of the Pronghorn (Antilocapra americana)

Project Leader: B. W. O'Gara
National Bison Range, U.S. Fish and Wildlife Service; Yellowstone National Park, U.S. National Park Service; and the Montana Fish, Wildlife and Parks Department

Objectives:

To study:

1. the reproductive physiology of male and female pronghorn;
2. the physiology and function of scent glands;
3. food habits related to changes in range conditions;
4. horn growth and casting; and
5. the relationships of pronghorns to other artiodactyls.

Rusults:

Work was continued on the pronghorn book.

Population Studies of Canada Geese in the Flathead Valley

Project Leaders: J.J. Craighead and I.J. Ball

Objectives:

1. To gather current data on populations, nesting areas, and nest success of Flathead geese.
2. To compare the current situation with conditions documented during 1953-60.
3. To relate changes in reproductive output of the geese to changes in habitat or management strategies since the 1950's.
4. To prepare a monograph using both historical and current data.

Results:

Travel funds are being sought for the final nesting surveys in April and May 1981. Anticipated date of monograph completion - December 1982.

Pronghorn Antelope Behavior in Northwestern Nevada - Southeastern Oregon

Project Leader:	B. W. O'Gara
Student Investigator:	J. O. Meeker
Cooperator:	U.S. Fish and Wildlife Service

Objectives:

1. To determine seasonal movements of pronghorns (Antilocapra americana) that summer on Hart Mountain and Sheldon Antelope Refuges.
2. To determine breeding strategies used by pronghorn with home ranges in two habitat types (Low Sage-Bunchgrass and Playa).
3. To analyze any differences noted in objective 2 above in an ecological and behavioral framework.
4. To determine trace element content of vital organs and hair of pronghorn taken at Sheldon and Hart Mountain Wildlife Refuges.
5. To establish trace element baseline data for pronghorns at Sheldon and Hart Mountain Wildlife Refuges.
6. To compare trace element data from Sheldon and Hart Mountain with hair taken from Idaho and Montana pronghorns.

Results:

A location flight was made on September 18, 1980. Two additional animals had died since the previous flight and their collars were recovered. A 2-year-old buck that had been trapped at Hart Mountain was killed during the Oregon hunting season. This animal had remained in the area where he had wintered. This probably demonstrates a lack of home range fidelity in young males.

Identification of territorial bucks in the vicinity of a large playa was made with the aid of telephotography. Observations of these bucks revealed that they maintained their territories during the rut. They obtained females by visits to the playa and herding does back to their territories. One territorial buck was displaced by his neighbor during the latter part of the rut. The displaced buck remained peripheral to his old territory but did not actively participate in the rut. The bucks in the low sagebrush area remained territorial during the rut. One territorial buck was taken by a hunter and his territory was vacant for the remainder of the rut.

Samples of vital organs and hair were taken from animals shot at Hart Mountain and Sheldon Antelope Refuges. Additionally, hair samples were obtained from hunter kills in Idaho and Montana. Analysis of these samples is awaiting the receipt of additional funds.

The student investigator attended classes during the fall quarter.

Inventory and Analysis of the Range and Wildlife Resources, Wildhorse Island, Flathead Lake, Montana

Investigator:	L. Eddelman
Student Investigator:	D. Kautz
Cooperators:	Montana Fish, Wildlife and Parks Department, Nature Conservancy

Objectives:

To provide baseline data on the Island range and wildlife resources in order to evaluate, classify, and manage such resources relative to present and future goals and objectives. The inventory shall be aimed at total Island ecology rather than emphasizing specific factors pertaining to particular wildlife species.

Rusults:

Field work and most data analyses have been completed. Survey categories include landtypes, soils, existing cover types, potential habitat types, range conditions, bird and mammal species, and general patterns of use by bighorn sheep (Ovis canadensis), mule deer (Odocoileus hemionus), waterfowl, Bald Eagles (Haliaeetus leucocephalus), and other hawks. The thesis will be finished by March 1981.

Forage Selection and Habitat Use of the Sumatran Rhinoceros in Malaysia

Project Leader:	B. W. O'Gara
Student Investigator:	R. Flynn
Cooperators:	Malaysia Department of Wildlife and National Parks, World Wildlife Fund International

Objectives:

1. To determine the kinds, relative amounts, and characteristics of forage selected by the Sumatran rhino (Dicerorhinus sumatrensis) in the Endau-Rompin area of southern Penisular Malaysia.
2. To describe the habitats used by the rhino, especially at feeding sites.

Rusults:

The student investigator is in Malaysia collecting data. He will return to the University in spring 1981.

Ecological Study of American Marten in Glacier National Park, Montana

Project Leader:	B.R. McClelland
Student Investigator:	G. Burnett
Cooperators:	U.S. Fish and Wildlife Service, U.S. National Park Service, University of Montana

Objectives:

1. To investigate fluctuations in a marten population and its prey base.
2. To document marten movements and activity patterns.
3. To describe habitat use by resident and dispersing marten.
4. To propose long-term management guidelines for marten habitat in spruce-fir habitat types in western forests.

Results:

Field work was conducted from March 1979 to September 1980. Data were gathered by live-trapping, radio collaring, and relocating marten. Trapped marten were fed and watered, ear-tagged, and weighed; sex and age were determined, general condition, behavior, and breeding condition were also recorded. When a radio collared marten was relocated, its behavior and proximity to vegetation were recorded. In addition, the weather conditions, habitat type, cover type, cover class (logs, shrubs, forbs, soil/litter, and rocks), aspect, slope, horizontal configuration, and topography were recorded. Snow quality and quantity, depth of marten tracks, hunting sites, and travel routes were described for winter months. Small mammal plots were snap trapped to index the prey population. Marten scats were collected along trails. The study area was habitat and cover typed.

A total of 1072 trap days resulted in 68 captures of 29 individual marten. Six juveniles and 5 adults were fitted with radio collars. Over 170 relocations have been made of collared marten in addition to hundreds of "line-of sight" signal readings.

Data analysis is underway and the thesis will be completed by June 1980.

Determining the Value of Riparian Habitats to Nongame Birds and Assessing the Effects of Livestock Grazing on Avian Community Structure

Project Leader:	R. Hutto
Student Investigator:	S. Mosconi
Assistant:	J. Marslof
Cooperators:	U.S. Fish and Wildlife Service, Denver Wildlife Research Center

Objectives:

1. Define the value of riparian habitats to nongame birds.
2. Determine the effects of livestock grazing on the structure of avian communities in riparian habitats.

Results:

During the summer of 1980, the student investigator continued field work begun in 1979.

The 4 riparian sites were censused along belt line transects. For comparative purposes, 3 nearby forest sites were also censused. The riparian sites were paired by treatment (heavily grazed) and control (lightly grazed) in low elevation and high elevation locations. In both pairs of sites, the number of land bird species recorded and their total densities were found to be greater in the relatively ungrazed plots.

Foraging groups that showed the greatest differences in density between the paired sites were the flycatchers, insectivores (warblers and vireos), and ground foragers (thrushes). Data were collected on 16 vegetative variables and 4 subject characteristics for foraging or nesting observations made on species belonging to these groups.

These 16 vegetative variables were also measured at points located randomly from the census transect lines in each riparian site.

The student investigator is analyzing data using statistical package programs (Nie et al. 1975), writing, and taking courses. The thesis should be completed by June 1981 when a summary will be available for the Biannual Report

The Effects of 1080 Control of Columbian Ground Squirrels on Target and Non-target Mammal and Bird Populations

Project Leader:	B. W. O'Gara
Student Investigator:	J. C. Malloy
Cooperators:	Montana Departments of Agriculture, Livestock, and Fish, Wildlife and Parks.

Objectives:

1. To estimate changes in non-target bird and mammal populations subsequent to treatment on control and experimental areas;
2. To estimate changes in Columbian ground squirrel population levels subsequent to treatment on control and experimental areas; and
3. To estimate the toxicity of 1080 poisoned ground squirrel carcasses recovered in the field to selected mammalian and avian scavengers.

Results:

The student investigator has completed his field work and has begun writing his thesis. The thesis will be completed by June 1981, and an abstract will appear in the next biannual report.

Mission Mountains Grizzly Bear Study

Project Leader:	C. Jonkel
Student Investigator:	C. Servheen
Cooperators:	Bureau of Indian Affairs; Confederated Salish and Kootenai Tribe; U.S. Fish and Wildlife Service; Montana Department of Fish, Wildlife, and Parks; School of Forestry, University of Montana

Objectives:

1. Determine the seasonal habitat preference of grizzly bears in the Mission Mountain area.
2. Determine denning sites and denning activity of grizzlies in the Missions.
3. Determine population status, density, and distribution of grizzly bears on the Mission area.
4. Determine seasonal food habits of grizzlies in the Missions and relate food habits to habitat preferences.
5. Develop a management plan for the Flathead Indian Reservation based on sound biological data from research findings.

Results:

The student investigator continued work on his dissertation and completed full time classwork fall quarter 1980. The dissertation will consist of three chapters. The first chapter on Grizzly Dens and Denning Activity in The Mission Mountains was completed and submitted to the committee for review. This paper was also reviewed by the editor of The 4th Intl. Conf. on Bear Research and Management where it will be published. Final editing of this chapter is almost complete and will be returned to the editor in the next few weeks.

The second chapter, A Management Plan for Grizzly Bears in The Mission Mountains and the Flathead Indian Reservation is now complete as a committee draft and is in the hands of the typist. It will be distributed to the committee and the Flathead Reservation/BIA management staff in the next week when the typist is finished.

The third chapter on Movements, Food Habits, and Habitat Utilization of Grizzly Bears in the Mission Mountains is approximatly ½ complete with the introduction, methods, and study area sections complete and most tables and some of the results section completed.

An abstract of the denning activity chapter follows:

Five radio-collared grizzly bears (Ursus arctos horribilis) were tracked to 10 den sites from 1976 through 1979 in the Mission and Rattlesnake Mountains, Montana. Intensive helicopter surveys of typical den habitat selected by radio-collared bears yielded an additional 27 dens, and 4 dens were located from the ground. Of the

41 known dens, 39 were excavated in open sidehill park habitat between 2080 m and 2500 m. Two dens occurred under a timber canopy at 1250 m. These atypical dens were used for 2 years by an orphaned cub. Slope angle averaged 30° for 15 sites measured, and dens were on northeast and southwest aspects. Dens were not aggregated except for groups of 5, 3, and 2 dens. Use of a winter den as a summer bed by a bear was verified in 1 case and suspected in 2 others. Two adult male black bears (Ursus americanus) were radio-collared in the study area to determine their den site selection. Both denned under a forest canopy below 1800 m. Significant differences occurred between entrance height of excavated grizzly dens in the Missions and excavated black bear dens in Idaho suggesting that this measurement may be a useful indicator of the bear species that excavated a den.

Nesting and Feeding Habits of Trumpeter Swans

Project Leader:	R. L. Hutto
Student Investigator:	Paul Hampton
Cooperators:	U.S. Fish and Wildlife Service, Harriman State Park, Targhee National Forest

Objectives:

1. To quantify plant and animal materials eaten by Trumpeter Swans on the Henry's Fork during winter.
2. To quantify the structural (vegetative or physical) features that are necessary to provide nesting and feeding areas during winter.
3. To quantify plant and animal material located inside exclosures that would be utilized if the barriers were absent.
4. To establish time budgets for the swans on the breeding range in the Targhee National Forest to determine the amount of time spent on the nest.
5. To establish nest temperature records to determine the extent of egg cooling.

Results:

The first egg was laid on 9 May at Swan Lake, on 10 May at Chain Lake, and on 23 May at Silver Lake. The nest monitoring equipment was installed on each of these nests after two eggs had been laid. Except for the destruction of the artificial eggs by the swans, the equipment functioned without major complications. Three of the 4 eggs on Chain Lake hatched on 19 June, followed on 20 June by all five eggs on Swan Lake. The Silver Lake clutch was abandoned on the eleventh day of incubation because the nest was constructed on an active muskrat (Ondatra zibethica) lodge. Within 4 days after hatching, four of the five cygnets on Swan Lake and two of the three cygnets on Chain Lake had died. As of 1 November, the other two cygnets were still alive.

Throughout the summer and early fall, three swan carcasses and five unhatched eggs were recovered and sent to the National Health Laboratory in Madison, Wisconsin. The necropsy reports have not been recieved, but a follow up report on a swan turned in last winter was recieved. Analysis of blood smears taken prior to the bird's death shows evidence of regenerative anemia. This winter, we hope to investigate the cause of the anemia.

On 25 October, the aquatic vegetation and insect larvae present on that portion of the Henrys Fork River within Harriman State Park were resampled. Initial observations showed that the River is considerably higher than last year, but there are no major changes in either plant volume or distribution.

On 21 November, observations were begun on swan behavior and feeding habits within Harriman State Park and Yellowstone National Park. Throughout the rest of the winter variations in behavior or feeding habits between those birds that winter in Yellowstone National Park and those that winter on the Henrys Fork will be observed.

The nest monitoring part of the study will again be performed in the spring utilizing, if possible, the same three nests as last year and two new nests.

Habitat Selection, Populations, and Control of Black-Tailed Prairie Dogs (*Cynomys ludovicianus*) on the Charles M. Russell National Wildlife Range

Project Leader:	B. W. O'Gara
Student Investigator:	C. Knowles
Cooperator:	U.S. Fish and Wildlife Service, Charles M. Russell National Wildlife Range

Objectives:

1. Determine distribution, size and status of all prairie dog towns within the Wildlife Range;
2. determine habitat selection by prairie dogs within the Wildlife Range;
3. determine population dynamics of prairie dogs and identify environmental factors which may influence numbers of prairie dogs within and between years within a prairie dog town;
4. investigate the dynamics of colonization by prairie dogs of the Wildlife Range;
5. evaluate and compare the effectiveness of three possible methods of control--poisoning, shooting and habitat alteration; and
6. investigate the association and relationship of prairie dogs to areas of intensive livestock use and/or areas of human disturbance.

Results:

The student investigator has completed his field work and is analyzing data. The dissertation should be completed by December 1981.

Morphological Variations Within the Subspecies Ursus arctos horribilis

Project Leaders: P.L. Wright
Student Investigator: H. W. Sherwood
Cooperators: Montana Department of Fish, Wildlife and Parks, Bozeman Laboratory; Western Wildlands

Objectives:

1. To develop new procedures for accurately measuring variations in cranial characteristics with regard to age and sexual dimorphism; and
2. to further clarify understanding of the systematics of the brown/grizzly bear complex in North America.

Results:

The student investigator is analyzing data and writing his thesis. A summary should appear in the next biannual.

Winter Ecology of Mule Deer in the Rattlesnake Gulch Area

Project Leader: I.J. Ball
Student Investigator: R. Yeager
Cooperators: Confederated Salish and Kootenai Tribes; Bureau of Indian Affairs; National Rifle Association

Objectives:

1. Document the relative importance of various habitat types to the mule deer that winter in the Rattlesnake Gulch Area.
2. Describe movement patterns of the deer and distribution on the winter range.
3. Estimate population size and age/sex composition.

Results:

The student is presently in the field. Backtracking and bed site data are being collected as conditions permit. Efforts are continuing at trapping deer for instrumentation with radio collars. Radio-tracking of deer instrumented last year is conducted on a regular basis. Field work will continue through March, at which time the student will return to the University.

A Study of Social Organization, Social Behavior, and Reproduction in Rocky Mountain Bighorn Sheep on the National Bison Range, Moiese, Montana

Project Leader:	D. Jenni
Student Investigator:	J. Hogg
Cooperators:	Montana Fish, Wildlife, and Parks Department; National Rifle Association; The National Bison Range

Objectives:

1. To compile a catalog of the frequency of occurence and the social context of selected behavioral acts, with special emphasis on behavior during rut;
2. To characterize social organization using the following parameters: group size, group sex ratio, group age structure, dispersion of groups and individuals within groups, relative group movement;
3. To determine estrous dates, conception dates, lambing dates and lamb survivorship; and
4. To begin testing certain hypotheses regarding the effects of trophy hunting on bighorn reproduction and sociality. These data - for a non-hunted population - will be compared with similar data for the same population in a later study after trophy hunting has been simulated by removal of three-quarter or greater curl rams.

Results:

The study is ongoing. All animals are individually known by natural or artificial horn marks. Approximately 1200 hours of structured behavioral observations, 400 hours of census in rut (1979 and 1980) and 200 hours of census in lambing (1979) are completed. The study will continue through spring 1982.

Elk Habitat Selection and Use, Movements, and Home Range on a Disturbed Summer Range in Western Montana

Project Leader:	C. L. Marcum
Student Investigator:	J. Lehmkuhl
Cooperators:	Bureau of Land Management, Montana Forest and Conservation Experiment Station

Objectives:

1. Describe environment available to elk.
2. Describe elk habitat selection and use, movements and home range on a forested summer range subject to concurrent logging.
3. Compare data with information obtained in the "pre-disturbance" phase of the long-term study.

Results:

The student investigator is completing the thesis manuscript. An abstract will appear in the next report.

Grizzly/Black Bear Interactions and Competition

Project Leader;	C. Jonkel
Student Investigator:	H. Carriles
Cooperators:	U.S. Fish and Wildlife Service; National Park Service; Montana Department of Fish, Wildlife and Parks; U.S. Forest Service; University of Montana

Objectives:

1. Determine similarities and/or differences, if any, of grizzly and black bear food habits from radio-location data and scat analysis.
2. Compare the habitat component preferences of both species:
   a) On an individual home range basis where a grizzly and a black bear overlap.
   b) By differences between species within the study area.
3. Evaluate grizzly and black bear food habits in the context of phenology, productivity, and nutrient content of certain important plant foods.
4. Compare the feeding strategies of both species in areas of range and home range overlap. Identify and investigate temporal and/or spacial separation or exclusion on preferred feeding sites.

Results:

The student investigator remained in the field until the end of September. He took classes during fall quarter. Trapping efforts continued, however, through the end of October. A total of 11 grizzly and 12 black bear captures were made during the field season. Five black bears and approximately ten grizzly bears remained collared at denning time.

Location data, scat analysis, and phenology data are being compiled and analyzed. Classes will be taken both winter and spring quarter with field work continuing in spring of 1981.

The Food Habits of and Habitat Selection by a Barren Ground Grizzly Female and Cubs, Brooks Range, Alaska

Project Leader:	B. W. O'Gara
Student Investigator:	J. Hechtel
Cooperators:	Alaska Department of Fish and Game, Naval Arctic Research Laboratory, National Wildlife Federation, Wildlife Management Institute, National Audubon Society, Theodore Roosevelt Memorial Fund of the American Museum, Arctic Institute of North America

Objectives:

1. To examine in detail the seasonal food habits of a female grizzly and her two offspring, and to provide a general account of bear food habits on the western North Slope.
2. To determine daily movement and activity patterns, seasonal movements and the home range of the bears.
3. To describe and map portions of habitat within the home range of the family group.
4. To determine the seasonal habitat use patterns of the bears.
5. To conduct qualitative analysis of important bear food items.

Results:

The student investigator is working in Alaska. He will return to the University and complete his thesis soon.

Effects of Subdivisions and Grazing on Grant Creek Wild Ungulates

Project Leader:	B.W. O'Gara
Student Investigator:	D. Weybright
Cooperators:	Montana Fish, Wildlife and Parks Department, The National Wildlife Federation

Objectives:

1. To determine ungulate numbers, concentration areas, and migration routes on a traditional winter range prior to subdevelopment.
2. To determine forage production, utilization and range condition.
3. To document the process of subdevelopment and cattle grazing and make recommendations to minimize the negative impacts.

Results:

Pellet group transects located on the winter range indicate approximatley 27 elk used this range during the winter of 1980. This information closely correlates with sightings made by local residents during this time.

The student investigator took coursework this fall and is preparing 10 radio collars and 5 clover traps for the winter trapping operation.

Ecology of the Bobcat in a Coniferous Forest Environment

Project Leader:	J. Ball and C. J. Jonkel
Student Investigator:	R. Olson
Cooperator:	Montana Department of Fish, Wildlife and Parks

Objectives:

1. Describe overall status of western Montana bobcat populations and evaluate their structure and dynamics.
2. Characterize habitat requirements, home range, and general movements.
3. Delineate reproductive processes and relate them to the state of overall population.
4. Evaluate food preferences by stomach analyses and scats.
5. Suggest management options based on the results of this study which could improve management of bobcats.

Results:

Graduate Student Randy Olson arrived in October and began trapping in late November. Intensive efforts along the Clark Fork/Garnet front, an area that supports heavy commercial trapping produced no captures and few track sightings. In late December, trapping efforts were shifted north into inaccessible areas with little commercial trapping occurs. Several track sightings and one capture of a 27 lb male bobcat occurred before weather conditions deteriorated. Trapping efforts continue but we expect little success until snow conditions improve.

Pathology of *Sarcocystis hemionilatrantis*

Project Leader:	B.W. O'Gara
Student Investigator:	D.B. Pond
Cooperator:	National Bison Range

Objectives:

1. To conduct a survey and establish *Sarcocystis* infection rates in the ungulates of the National Bison Range.
2. To determine the life cycle of *Sarcocystis* sp. found in Mule deer, white-tailed deer, and coyotes.
3. To determine pathology in the respective hosts.

Results:

During mule deer herd reductions, 65 deer surveyed were infected with *Sarcocystis hemionilatrantis*.

Sarcocystis sporocysts are being collected from experimentally infected coyotes in preparation of pathology studies in mule deer and white-tailed deer this spring.

Morphological Variation Among Bobcat Populations in the Northwestern United States

Project Leader: I.J. Ball
Student Investigator: S. Albert
Cooperators: NRA (tentative)

Objectives:

1. Clarify morphological affinities of bobcats from the northwestern United States with respect to cranial characters:
    a. identify geographical differences in distinct subspecific populations of bobcats based on craniometric characters.
    b. examine sexually dimorphic properties of bobcats among and within several distinct populations.
2. Describe taxonomic affinities and phylogenetic relationship of bobcat populations.
3. Identify craniometric criteria for the differentiation of bobcats and lynx (Lynx canadensis) groups from the northwestern U.S.

Results:

Thirty-five cranial, mandibular and dental measurements of bobcat (Felis rufus) skulls will be collected from 18 contiguous populations in northwestern America and Canada (Montana, Idaho, Washington, Oregon, and British Columbia). These data will be statistically compared to assess differences in two subspecies, F. r. pallescens, the interior form, and F. r. fasciatus, the coastal form. Variation in size and skull shape, sexual dimorphism, and differences associated with geographic location will be examined. The relative effectiveness of physiographic features (Columbia River, Continental Divide, etc.) as barriers to genetic mixing of populations will be analysed. Intra-specific size variation will be compared to a set of quantified environmental factors to seek any causal relationships describing specific adaptations to climatic gradients. Univariate, bivariate, and multivariate statistical techniques will be used to evaluate data. Computer cartographic techniques (SYMAP, ASPEX) are to be utilized to describe patterns of variation.

The student investigator has completed measuring the majority of skulls. Data analysis will begin in February 1981. His thesis is expected to be completed late spring 1981.

Characteristics of a Hunted Mountain Lion Population (*Felis concolor*) in Western Montana

Project Leaders:	B.W. O'Gara and K.G. Greer
Student Investigator:	Kerry M. Murphy
Cooperators:	Montana Department of Fish, Wildlife, and Parks; National Rifle Association; U.S. Forest Service

Objectives:

1. To examine age structure, density, natality, and the distribution of mountain lions in hunted and unhunted drainages of the study area.
2. To investigate hunting pressure and harvest of mountain lions in the study area, and relate those data to population characteristics.
3. To determine timing and distance of dispersal by young animals and the age of sexual maturity in males.
4. To identify and describe winter habitat requirements of mountain lions in the study area, specifically those relating to the aquisition of prey.

Results:

Since December 1979, lions have been treed on 16 occasions. Six adults have been instrumented with radio transmitters and one kitten ear-marked. Eighty-seven radio relocations have been obtained to date.

At least ten tag holders spent a minimum of 20 days hunting in the Fish Creek Drainage during the 1979-80 lion season. The known harvest consisted of one unmarked female, two unmarked males, and one radio-collared male.

The second winter field season began 1 December 1980 and will continue through March 1981.

Summer Range Ecology of White-tailed Deer in the Coniferous Forests of Northwestern Montana

Project Leader:	B. W. O'Gara
Student Investigator:	Rosemary Leach
Cooperator:	Montana Fish, Wildlife and Parks Department

Objectives:

The primary objective of this study is to determine basic summer habitat use by white-tailed deer in the Swan Drainage. Secondarily, to evaluate the possible influences of fire and logging on summer habitat.

Results:

From 1 July to mid-September, 10 radio equipped deer were monitored for a total of 215 relocations. Deer locations were marked on 4 inch to the mile aerial photographs. Most of the relocations were made by ground tracking. Two tracking flights were made from a fixed-wing aircraft. In addition, three deer were monitored for a 24-hour period for circadian activity.

Next season I will continue tracking deer; the bulk of tracking time will be used to delineate home ranges for the new deer that will be trapped and collared this winter. The remainder of the field season will be devoted to habitat typing and mapping of home ranges.

Preliminary findings show that white-tailed deer summer throughout the Swan Valley at low to mid elevations. Deer radio-collared in this study wintered in the Upper Swan area from Goat Creek to Dog Creek, and summered south of the winter range. The bulk of the deer from the upper Swan winter range summer from Condon south to the Swan-Clearwater divide. Some deer summer north of the winter range, although none presently have working transmitters. Also, three radio-collared deer summer south of the Swan-Clearwater divide, south to Lake Inez.

Summer home ranges are small areas of approximately 160 acres. They are composed of small activity centers near riparian habitat, and comparitavely larger foraging areas in forested upland habitat; all have a high degree of interspersion, or diversity. The timbered areas are very diverse with respect to habitat types.

Summer home ranges of six radio-collared deer included clearcuts. Heaviest use seemed to be in clearcuts with extensive visual cover, and cuts with riparian habitat. Of 215 relocations for the field season, 110 were in timbered areas, 83 in riparian habitat, and 22 in clearcuts.

Seasonal Habitat Selection Movements and Home Range Size of Bobcats (*Lynx rufus*) in Northcentral Montana

Project Leader:	B. W. O'Gara
Student Investigator:	P. R. Knowles
Cooperators:	Charles M. Russell National Wildlife Refuge

Objectives:

1. To determine home range size and spatial arragements of bobcats on the study area;
2. to determine seasonal habitat selection and movements of bobcats on the study area; and
3. to provide recommendations for management guidelines to the Charles M. Russell National Wildlife Refuge and the Montana Department of Fish, Wildlife and Parks.

Results:

The student investigator has completed her field work and is analyzing data. The thesis should be completed during spring 1981.

A Study of an Introduced Mountain Sheep Herd near Paradise, Montana

Project Leader:	J. Harris
Student Investigator:	L. Kopec
Cooperators:	U.S. Forest Service; Montana Fish, Wildlife, and Parks Department

Objectives:

1. Locate and map seasonal ranges and movements.
2. Census the herd.
3. Assess productivity.
4. Compare general health and vigor to the Wildhorse Island herd.
5. Make management recommendations regarding possible habitat manipulation and future harvest.

Results:

No distinct migrations from winter to summer ranges have been noted. Seasonal movements are confined to an expansion of the winter range as snow recedes and a movement of ewes to lambing cliffs in early May. Sheep were frequently seen east of Sheep Creek during the late summer and early fall, expanding the herd's range by about 2 miles. Previously, sightings in that area were rare.

The June ewe:lamb ratio was approximately 100:70. Four 2-year-old rams and at least 1 2-year-old ewe have immigrated to the Cut-off area from a nearby herd. One of these rams died from pneumonia during the summer. No other mortalities have been noted. The current population estimate is around 70 sheep.

Pellets collected in early April were analysed for the presence of lungworm larvae. The herd has a very low degree of lungworm infestation.

Field work during the summer included vegetation-type surveys, telemetry work, and censusing. Trapping was unsuccessful. Field work will be continued through Spring 1981.

Ecology and Management of the River Otter in Southwestern Montana

Project Leader: B.W. O'Gara
Student Investigator: H. Zackheim
Cooperators: Montana Department of Fish, Wildlife, and Parks; National Wildlife Federation

Objectives:

1. To develop a technique to survey river otter populations.
2. To determine relative densities of otters on area rivers.
3. To identify characteristics of otter habitat.
4. To assess the impacts of harvest on otter populations.

Results:

Following consultation with research advisers, it was decided to initiate efforts to livetrap otter, instrument with transmitters and monitor movement and habitat use. Six trap sites were selected on the Jefferson River north of Twin Bridges. The trap sites were all on wooded islands where otter had been hauling out of the river to latrine sites on the bank. Modified Hancock livetraps (as described by Melquist and Hornocker, 1979) were concealed and set at these sites and the traps were checked daily. On October 1, after 49 trap-nights over 19 days, a 21-pound, 3-5-year-old male otter was captured.

On October 5, Wayne Melquist, an otter researcher from McCall, Idaho, performed an intraperitoneal implant of a Telonics transmitter in the otter. The animal was released at the site of capture on the same day.

Due to the absence of roads near the river and the otter's mobility, radio contact has been only sporadic with the instrumented animal. The otter was initially relocated within 500 m of the release site on October 6 and subsequently located from an airplane on October 19 about 8 km upstream from that site on the Big Hole River, a major tributary of the Jefferson. On 10 December, the otter was located another 8 km up the Big Hole, or approximately 16 km from his initial capture and release site.

Habitat Selection and Use, Movements, and Home Range of Malaysian Seladang (*Bos gaurus hubbacki*) on a Disturbed Range in Central Pahang, Malaysia

Project Leader: B.W. O'Gara
Student Investigator: P. Conry
Cooperators: Department of Wildlife and National Parks Malaysia, Smithsonian-Peace Corps Environmental Program, U.S. Peace Corps Malaysia

Objectives:

1. To develop chemical capture techniques and establish guidelines for drug dosages.
2. To describe seladang habitat use and selection, movements, and home range in the Lepar River study area.
3. To describe seladang food habits.
4. To investigate seladang interactions with man, including:
   a) impacts of agricultural development and associated disturbance,
   b) impacts of logging activities and associated disturbance,
   c) response to habitat management projects.
5. To suggest guidelines for management of seladang in disturbed habitats.

Results:

The student investigator took courses and worked on his thesis during the reporting period.

Ecology of Sage Grouse on the INEL Site

Project Leader: I.J. Ball
Student Investigator: J. Connelly
Cooperators: U.S. Department of Energy, Idaho National Engineering Lab

Objectives:

1. Quantify the number of sage grouse on the 900 mi^2 INEL Site throughout the year.
2. Determine the primary or "key use" area of both resident and migrant sage grouse on the INEL Site.
3. Determine migration routes and summer locations of sage grouse wintering on the INEL Site.
4. Determine radionuclide concentrations in grouse on the INEL Site and determine, in particular, the movements of grouse utilizing areas known to contain "above background" concentrations of radionuclides.
5. Describe the sage grouse wintering areas (in particular the vegetation) on and near the INEL Site.

Results:

Field work is essentially complete and preparation of the dissertation/publications is well underway. Estimated completion date is September 1981.

Movements and Ecology of Bald Eagles Associated with Autumn Concentrations in Glacier National Park, Montana

Project Leader:	B.R. McClelland
Research Associates:	H.L. Allen, J.G. Crenshaw, P.T. McClelland, D.S. Shea
Student Investigator:	L.S. Young
Cooperators:	USDI, National Park Service, National Park Service Research Center, Laramie, Wyoming: USDI, National Park Service, Glacier National Park West Glacier, Montana; University of Montana; Colorado Department of Natural Resources, Division of Wildlife, Grand Junction, Colorado; Utah Division of Wildlife Resources, Salt Lake City, Utah; USDI, Bureau of Land Management, Salmon, Idaho; Salt Lake City, Utah; USDA, Forest Service, Challis National Forest, Challis, Idaho; Idaho Department of Fish and Game, Boise, Idaho.

Objectives:

1. To determine migration routes, wintering areas, and summer ranges of bald eagles associated with autumn concentrations in Glacier National Park, Montana.
2. To study local movements and ecology of this group of eagles throughout the course of seasonal movements.
3. To study spatial and temporal relationships among bald eagles, habitats, and specific habitat components through analysis of local and long-range movements and local ecology, and to identify habitats essential to this group of eagles.
4. To develop and present guidelines for coordinated, regional management of habitats used by transient bald eagles throughout western North America, and to provide specific recommendations for management of essential habitats identified.

Results:

Field work for 1980-1981 began at Glacier National Park, Montana on 15 September 1980. Autumn 1980 was atypical with respect to the bald eagle (Haliaeetus leucocephalus) concentration. Low numbers of spawning kokanee salmon (Onchorhynchus nerka) led to a depressed peak number, earlier-than-normal departures, and shorter-than-normal residency times for the majority of eagles. Peak count was 377 eagles which occurred on 5 November 1980.

Capturing was initiated on 2 October 1980 and was terminated on 11 December 1980; 52 eagles were captured during this period. Fourteen eagles; 6 adults, 4 subadults not hatch-year, and 4 hatch-year; were equipped with rectrice-mounted radio-transmitters. An improved, prototype transmitter package was used this season incorporating 50% longer life (9 mos.) and improved packaging while retaining approximate

weight and tip-switch feature of transmitters used in 1979. Seven transmitters were mounted dorsally and 7 were mounted ventrally to compare field performance and evaluate impact of the 2 positions on the birds. Transmitter-attachment was staggered over the course of the season with respect to age class. Detailed morphological measurements were taken on all 52 captured eagles and blood samples were obtained from 37. Blood samples were shipped to the Patuxent Wildlife Research Center in Laurel, Maryland where analyses for heavy metal, halogenated hydrocarbon, and polychlorinated biphenyl residues will be performed.

Local movements, activity, and habitat-use were studied at Glacier throughout the autumn. Following dispersal from Glacier, eagles were tracked by vehicle and fixed-wing aircraft. At present, some transmitter-equipped eagles have reached known or probable wintering areas while others are still in the course of southward movement. Three eagles are wintering in the Rush Valley, Utah, an arid, high-elevation valley in central Utah approximately 50 km west of Utah Lake. This at last establishes a link that has long been suspected but never proven; the Rush Valley winter concentration has been known for many years, but until now the origin of the eagles had been unknown. Intensive local study of movements and activity is continuing, but to date the eagles have shown fixed movement and activity patterns and will probably remain in the Valley until they begin northward movement in late winter/early spring. Three other eagles have moved into northeastern Utah between the Wasatch Range and the Bear River Divide but are still in the period of southward movement, and their final destinations are unknown. One eagle is on the Salmon River near Challis, Idaho. At present it is uncertain whether this eagle will remain there for the winter or not. Two eagles appear to be wintering in the Swan Valley/Ovando Valley area of Montana. One has been in the Swan Valley since it departed Glacier in late October while the other has ranged in the area since mid-December. It is likely that they will remain in these valleys or the Flathead Valley for the winter. Other transmitter-equipped eagles have been located at various places in western Montana, southeastern Idaho, and southwestern Wyoming. Long-range tracking and intensive local study of movements, activity, and habitat use is ongoing and will continue through winter and spring.

Winter Habitat Selection and Movement of Elk (Cervus elaphus) in the Drainage of the Middle Fork of the Flathead River, Montana

Project Leader:	B.W. O'Gara
Student Investigator:	M. McDonald
Cooperators:	Montana Fish, Wildlife, and Parks Department; Flathead National Forest

Objectives:

1. To describe and determine winter habitat type and use.
2. To determine seasonal migratory routes via monitoring of radioed and collared elk.

Results:

Mike McDonald has completed his thesis. The abstract follows:

Elk (Cervus elaphus nelsoni) that wintered along the Middle Fork of the Flathead River were investigated from January through May 1977 and 1978. Eight cow elk were radio-collared and 8 calves and bulls were fitted with rope collars. Population structure, winter mortality, winter range fidelity, movements on the winter range, and browse utilization were studied. Calf:cow ratios obtained from ground counts were 47:100 in 1977 and 48:100 in 1978, considerably higher than indicated by aerial count data, 19:100 and 23:100. No winter kills were found in 1977 and only 3 were found in 1978. None of the dead elk were calves, indicating high calf winter survival during both years. All 5 elk radio-collared during 1977 and at least 1 rope-collared elk returned to the winter range in 1978, implying high fidelity. Population estimates of wintering elk ranged from 184 to 270 with a weighted mean of 233 animals. Elk use in respect to elevation and slope configuration differed substantially between the mild winter of 1977 and the near-normal winter of 1978. A horizontal shift to concave and straight configurational draws and slopes was noted during February and March 1977 because of low snow accumulation. During the same months in 1978, habitat use was restricted to convex, open ridges. April comparisons showed the animals moving upward and using previously snowbound slopes in 1977 but using lower draws and drainages during 1978. Browse surveys indicated a preference for Rocky Mountain maple over serviceberry. Vigor of both species was low, most plants were less than 4 feet (1.2 m) tall; nearly 40% of all plants were decadent, and 45% of all plants classified were in form class 3, indicating consistently high utilization.

A Comparison of Feeding and Nesting Habitat Use by Woodpeckers in First and Second Year Burns

Project Leaders:	B.R. McClelland, J.H. Lowe
Student Investigator:	M. Harris
Cooperators:	McIntire-Stennis, University of Montana School of Forestry, Champion International

Objectives:

1. To compare woodpecker population densities within and adjacent to the burns.
2. To identify bark- and wood-inhabiting insect species and their distributions within the study areas.
3. To characterize woodpecker foraging habits within the burns.
4. To characterize woodpecker nest sites within and near the burns.
5. To propose management guidelines for post-fire logging which would maintain suitable habitat for woodpeckers and associated cavity nesters.

Results:

Three species of woodpeckers, the Hairy (Dendrocopos villosus), Northern Three-toed (Picoides tridactylus), and Black-backed Three-toed (P. arcticus) were observed during the breeding seasons of 1979 and 1980. The first year's observations were made in a 2-year post-fire burn of 1,200 acres. During 1980, the study was continued in a 1-year post-fire burn of 300 acres.

During 1979 woodpecker densities within and adjacent to the burn were 1.3 and 0.09 individuals per acre, respectively. In 1980, woodpecker densities in the 1-year burn site were approximately 0.4 individuals per acre. Returning during the spring of 1980 to the previous year's study site, which by this time was 3-years post-fire, woodpecker densities were estimated to have dropped to 0.16 individuals per acre.

Significant differences (.05) in tree species selection for foraging were found between all 3 woodpecker species the first spring and between D. villosus and P. arcticus the second spring. A significant difference in foraging heights was observed only between D. villosus and P. arcticus the second season. All 3 species the first year and D. villosus and P. arcticus the second year selected trees of significantly different size classes.

Currently, results of the insect rearing study are being recorded. These data along with the woodpecker nesting and foraging data will be compared to estimates of habitat availability to determine possible insect and woodpecker preferences.

Cabinet Mountains Grizzly Bear Study

Project Leaders:	C. Jonkel and B.W. O'Gara
Field Research Leader:	T. Thier
Field Assistants:	D. Jandreau, M. Mantas, S. Mack, J. Almack, B. Anderson, and M. Madel
Cooperators:	U.S. Forest Service, Border Grizzly Project (U. of M.), Montana Department of Fish, Wildlife and Parks, and U.S. Fish and Wildlife Service

Objectives:

1. Capture, mark, and radio-track resident grizzlies and gather base-line information in reference to their habitat utilization and general ecology.
2. Document, evaluate, and map habitat components present within the area.
3. Collect and evaluate reports of grizzly observations by local residents.
4. Document impacts on grizzly habitat by various human activities.
5. Identify and map critical sites such as spring ranges, denning areas, etc.

Results:

Primary emphasis was to capture and radio-collar a grizzly. During 5 months of intensive effort, 1 yearling grizzly was captured. Unfortunately, it was able to free itself from the foot-snare before it could be tranquilized and marked. Present with the yearling cub at the time of capture was its mother. A third grizzly was observed in the western portion of the study area. Biological data on 26 black bear captures during trapping efforts were collected and tabulated.

In addition to the grizzly sightings by study personnel, evidence of grizzlies was observed on at least 8 occasions. This evidence occurred in the form of scats, tracks, digs and hair. Habitat components are being mapped and described for a portion of the study area. An area presumed to be an important travel corridor between the East and West Cabinets was extensively examined.

A final report on all facets of the study is scheduled to be released in late January, 1981.

Population Fluctuations and Distribution Patterns of Mallards in the Pacific Northwest

Project Leader:	I.J. Ball
Student Investigators:	Michael J. Rabenberg and Lois Regen
Cooperators:	U.S. Fish and Wildlife Service, Refuge Division, Portland; Battelle Pacific Northwest Laboratories.

Objectives:

1. Document factors influencing the number of mallards wintering in the Columbia Basin.
2. Document timing, duration, and distance of mallard feeding flights.
3. Investigate interchange of birds between major resting areas.
4. Determine food and field-type preferences of wintering mallards.
5. Document any changes in average physical condition of mallards over the winter.
6. Study the dynamics of flock composition, flock sizes, sex ratios, and pair status over time and between areas.
7. Analyze band recovery data from mallards banded in the Pacific Northwest.

Results:

Project personnel completed keypunching more than 17,000 data cards during November. Analysis of the data is proceeding. Expected completion date of Mike Rabenberg's thesis and the overall project summary is June 1981.

Black Bear Ecology and Management in the Northern Conifer-Hardwood Forests of Maine

Project Leaders:	C. Jonkel and L. Pengelly
Student Investigator:	R. Hugie
Cooperators:	Maine Department of Inland Fisheries and Wildlife, University of Montana, University of Maine, National Rifle Association, Penobscot Valley Conservation Association, Border Grizzly Project

Objectives:

1. To determine black bear habitat and its use by bears in Maine.
    a. Describe available habitat in terms of cover types, topography, current use, and road networks.
    b. Describe bear distribution and movements in available habitat.
    c. Describe patterns of black bear behavior such as seasonal activity, sex and age similarities in movements, and how bears relate to human activity within their range.
2. **To describe how black bear habitat can be perpetuated.**
    a. **Describe the effects of forest practices, fire, and other** activities on bear habitat.
3. To describe the basic biological characteristics of black bears on the study area.

Results:

The student investigator is completing his dissertation. The summary should appear in the next Biannual Report.

CONSERVATION, EDUCATION, AND PUBLIC RELATIONS

B.W. O'Gara

10 July	Met with Grizzly Bear Recovery Team to plan research and management strategies.
14 July	Attended a research planning meeting on EPA studies of wildlife in the Flathead River Basin.
15-16 July	Attended meeting of Western Association of Fish and Wildlife Agencies, Kalispell.
16 July	Toured study area and discussed deer research with members of Montana Department of Fish, Wildlife, and Parks.
17-25 July	Reviewed a 6-page manuscript for J. Mammal. and a 3-page manuscript for J. Wildl. Manage.
17-25 July	Reviewed a 15-page manuscript for BIA biologists.
29 July	Met with C.S.K.T. and BIA biologists to discuss and plan research on mule deer ecology.
30 July	Met with a citizens group to discuss potential impact of a power line on an elk winter range.
15 August	Met with BIA biologists in Unit office and reviewed manuscripts they were preparing.
18-19 August	Collected and necropsied 5 deer for the Fish, Wildlife and Parks Department. These deer were drinking from a tailing pond at an antimony mine. The water is high in arsenic, lead, and antimony, and the deer showed evidence of stress. Samples of hair, meat, livers, hearts, and kidneys were quick frozen and taken to the chemistry laboratory in Bozeman for analysis.
18-19 August	Reviewed a 12 page manuscript for J. Mamm. and manuscripts (8 and 4 pages) for J. Wildl. Manage.
20-21 August	Attended a project leaders meeting at Fish and Wildlife Service Area Office in Billings. Gave a presentation on Unit operations.
5 September	Wrote a letter to Congressman Melcher, providing information on the potential impacts of motorized traffic in the Rattlesmake on a proposed reintroduction of mountain goats

8 September	Discussed research needs on refuges in Montana with Jon Malcolm, USFWS, Billings.
15 September	Met with Forest Service officials from Missoula and Washington D.C., to discuss research cooperation between the FS and University.
18 September	Attended CMRNWR Advisory Committee meeting , Lewistown.
22 September	Reviewed a 5-page manuscript for Mammalogy.
23 September	Immibilized a blind mountain goat at NBR so it could be treated for keratitis.
25-26 September	Necropsied a deer for Montana FWP Region 1 biologists and inspected a hunter-killed elk to assure edibility.
30 September	Met with FWP biologists in Helena to discuss river otter research programs.
30 September	Conferred via telephone with USFWS biologist, Kofa Game Range, on drugging and trapping Sonoran pronghorns. Detailed instructions on capturing pronghorns in linear nets were formulated and sent.
1 October	Consulted with Forest Service biologists on immobilizing bighorn sheep.
1 October	Attended a meeting on wildlife habitat preservation at Grant Creek.
3 October	Consulted with Idaho game biologist on obtaining breeding synchrony in a captive herd of elk.
20 October	Attended a meeting on wildlife habitat preservation at Grant Creek.
20 October	Consulted Office of Endangered Species concerning impacts of management programs at Charles M. Russell NWR on black-footed ferrets.
10 November	Consulted with Animal Damage Control personnel in New Mexico regarding methods for capturing eagles.
18 November	Consulted with US Forest Service biologists regarding immobilization of bighorn sheep.
18 November	Consulted with Area Manager's Office regarding a recommendation for person to serve as expert witness in potential lawsuit on management of the Charles M. Russell NWR.

1 December	Conferred with Friends of the Rattlesnake concerning management alternatives for the area.
3 December	Collected and necropsied a deer for Advanced Wildlife Conservation class (Forestry 475) - 40 students.
4 December	Conferred with US Forest Service Biologists concerning reintroduction of mountain goats to the Rattlesnake Wilderness Area.
5 December	Met with landowners and county agent concerning 1080 research.
22 December	Surveyed goat trapping prospects at the Bison Range.
23 December	Talked to a high school class on predation - 30 students
30 December	Conferred with BIA biologists concerning the edibility of a previously-tranquilized elk that was shot on the reservation.
30 December	Discussed research and management needs on golden eagles with the ADC agent who is formulating management plans.

I. J. Ball

16 July	Discussed Turkey research and management with biologists from western states and the Wild Turkey Federation.
17-25 July	Reviewed a 15-page manuscript for BIA biologists.
17-25 July	Reviewed a 20-page manuscript for J. Wildl. Manage.
29 July	Met with C.S.K.T. and BIA biologists to discuss and plan research on mule deer ecology.
15 August	Met with BIA biologists in Unit office and reviewed manuscripts they were preparing.
18-19 August	Reviewed a 12 page manuscript for J. Mamal. and manuscripts (8 and 4 pages) for J. Wildl. Manage.
20-21 August	Attended a project leaders meeting at Fish and Wildlife Service Area Office in Billings.
8 September	Discussed research needs on refuges in Montana with Jon Malcolm, USFWS, Billings.
15 September	Met with Forest Service officials from Missoula and Washington D.C., to discuss research cooperation between the FS and University.

18 September	Attended CMRNWR Advisory Committee meeting, Lewistown.
20 September	Made a 4 hour presentation on wetlands and waterfowl to a teachers workshop sponsered by NBR.
22 September	Reviewed a 6-page paper for J. Wildl. Manage.
30 September	Met with FWP biologists in Helena to discuss river otter research programs.
7 October	Spoke to UM Wildlife Club about volunteer opportunities at Montana FWP game check stations. Approximately 35 students were recruited and trained. They will provide approximately 130 person-days of volunteer service during the current hunting season.
10 October	Spoke to UM senior Wildlife Biology class on waterfowl ecology/management.
28 October	Attended a public hearing in Missoula on CMR NWR Environmental Impact Statement.
17 November	Presented a 3-hour lecture on waterfowl and gallinaceous birds to Montana Wildlife class (Zoo 201) - 45 students.
18 November	Presented a 1-hour talk on wildlife to a grade school class - 60 students.
19-20 November	Reviewed 182 page Grizzly Bear Recovery Plan for OCRU.
20 November	Reviewed a 22-page manuscript for the Journal of Wildlife Management.
September - December	Taught a 1-hour graduate seminar (Wildlife Biology 570) Logic and Design of Research Projects - 15 Students. Fall Quarter.

D.A. Jenni

9-13 June	Attended and presented a paper at the 1980 Annual Meeting of the Animal Behavior Society in Fort Collins, CO.
11-15 August	Attended and presented a paper at the 98th Stated Meeting of the American Ornithologist's Union in Fort Collins, CO.

P.L. Wright

January - May	Was at Arizona State University as a visiting Maytag Professor of Zoology.
February	Attended conference on Delayed Implantation in Thredbow, Australia.

M. Harris

1 August to 5 September	Student participant in U.S. Fish and Wildlife Cooperative banding program, stationed in Yorkton, Saskatchewan

J. Lehmkuhl

13 September	Attended New Mexico Section Meeting of The Wildlife Society, Los Alamos, New Mexico.

J. Malloy

29 October	Gave a presentation to representatives of 19 Montana counties and the Montana Departments of Agriculture, Livestock, and Fish, Wildlife, and Parks on research planned to document the hazards of 1080 poisoning of Columbian ground squirrels to nontarget species.

J. Meeker

August September	Participated in orientation for hunters at Hart Mountain National Wildlife Refuge, Oregon and Sheldon Antelope Range, Nevada.
November	Lectured on Pronghorn to a Basic Biology Course, University of Montana.

S. Mosconi

9-13 June	Attended the 98th Stated Meeting of the American Orinthologist's Union in Fort Collins, CO.
11-15 August	Presented a Poster Paper at the 98th Stated Meeting of the American Ornithologist's Union in Fort Collins, CO.

J.W. Connelly

3-5 October	Presented two papers at the annual meeting of the Idaho Ornithological Council, Pocatello, ID.

L. Young

Autumn	Presented research-objectives, methodologies, and purpose to general public, school groups, Park Service employees and administrators, and news, radio, and television media while at Glacier National Park.
14-15 June	A Symposium on the Bald Eagle in Washington. Seattle.
10-13 October	Raptor Research Foundation Annual Meeting. Duluth, Minn.

R. Leach

	Presentation of a first year project, "Summer range ecology of white-tailed deer in the coniferous forests of Northwestern Montana" at a coordination meeting for the CWRU

H. Carriles

24-26 July	Gave short presentation on Graduate project at Border Grizzly Technical Committee Meetings. At Whale Creek Community Center, North Fork, Flathead.

D. Kautz

July	Led a field trip on Wild Horse Island for Yellow Bay Biological station plant ecology students.

PUBLICATIONS

Connelly, J.W. and I.J. Ball. 1979. A preliminary report on the ecology of sage grouse on the Idaho National Engineering Laboratory Site. Pages 41-42 in O.D. Markham and W.J. Arthur, eds. Proceedings of the symposium on the Idaho National Engineering Laboratory Ecology Programs. IDO 12088. Nat. Tech. Inf. Serv., Springfield, Va. 72pp.

Sheldon,A.L. 1980. Coexistence of perlid stoneflies (Plecoptera): predictions from multivariate morphometrics. Hydrobiologia 71:99-105.

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UNPUBLISHED REPORTS

Connelly, J.W. 1979. Ecology of sage grouse on the INEL Site. Pages 43-49 in R.E. Autenrieth and G. Copeland, eds. Idaho Department of Fish and Game Job Progress Report W-160-R-6. 55pp.

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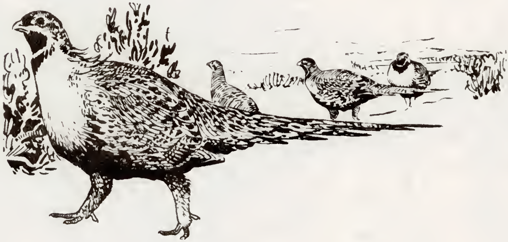
Hampton, P. A multiple sensor system for monitoring Trumpeter Swan nesting behavior. Seventh Annual Proceedings of the Trumpeter Swan Society.



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BIANNUAL REPORT

of the

MONTANA COOPERATIVE WILDLIFE RESEARCH UNIT

University of Montana

Missoula, Montana

to

UNIVERSITY OF MONTANA

MONTANA FISH, WILDLIFE, AND PARKS COMMISSION

WILDLIFE MANAGEMENT INSTITUTE

U.S. FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR

Vol. 30, No. 2
January-June 1980

Respectfully submitted,

Bart W. O'Gara

Bart W. O'Gara, Leader

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MONTANA COOPERATIVE WILDLIFE
RESEARCH UNIT PERSONNEL

Coordinating Committee

Robert F. Wambach, Montana Fish, Wildlife, and Parks Department, Helena
W. Leslie Pengelly, University of Montana, Missoula
Bart W. O'Gara, U.S. Fish and Wildlife Service, Missoula

Unit Staff

Bart W. O'Gara, Unit Leader
Joe Ball, Assistant Leader
John J. Craighead, Affiliate in Zoology and Forestry
John T. Harris, Forestry School
Donald A. Jenni, Zoology Department
Charles Jonkel, Forestry School and Montana Fish, Wildlife and Parks Department
Lee H. Metzgar, Zoology Department
W. Leslie Pengelly, Forestry School
Robert R. Ream, Forestry School
Andrew L. Sheldon, Zoology Department
Philip L. Wright, Zoology Department
"Ginger" Schwarz, Unit Secretary

Graduate Students

Sandra Martin
Bruce Cushing
Matt Wunder
Mark McNay
Jill Parker
Darrell Kautz
Tom Butts
Amy Lester
Patricia McBride
Dennis Daneke
Pete Zager
Rod Flynn
Jack Hogg
Len Kopec
Gary Burnett
Roy Hugie
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Steve Albert
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Paul Hampton
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Harrie Sherwood
Robert Yeager
John Malloy
Sandra Mosconi
Hugh Zackheim
John Lehmkuhl
John Hechtel
Pam Knowles
Jack Connelly
Mike Rabenberg

COOPERATING AGENCIES

University of Montana
Montana Fish, Wildlife, and Parks Department
Wildlife Management Institute
U.S. Fish and Wildlife Service

Alaska Fish and Game Department
Alberta Fish and Wildlife Branch
Arctic Petroleum Operators Association
Audubon Society
Bitterroot National Forest
Border Grizzly Project
British Columbia Wildlife Branch
Bureau of Indian Affairs
Bureau of Land Management
Canadian National Sportsmen's Shows
Canadian Wildlife Service
Churchill Northern Studies Centre
Denver Wildlife Research Center
Environmental Research Institute
Flathead National Forest
Friends of the Rattlesnake
Idaho Cooperative Wildlife Research Unit
Idaho Department of Fish and Game
Interagency Grizzly Bear Team
Maine Department of Inland Fisheries and Wildlife
Manitoba Department of Mines, Resources, and Transportation Services
McInntire Stennis
Montana Forest and Conservation Experiment Station
Montana Power Company
National Bison Range
National Geographic Society
National Rifle Association
Nature Conservency
Naval Arctic Research Laboratory, University of Alaska
Nevada Department of Fish and Game
New York Zoological Society
Norsk Polarinstitutt
Northwest Territories Fish and Wildlife Service
Parks Canada
Quebec Wildlife Service

Salish Kootenai Tribal Council
U.S. Forest Service
U.S. National Park Service
U.S. National Science Foundation
University of Alaska
University of Copenhagen
University of Guelph
University of Maine
University of Montana Foundation
University of Oslo
Washington Fish and Game Department
Wildlife Federation
World Wildlife Fund (Canada)
Wyoming Game and Fish Department
Yellowstone National Park

PERSONNEL NOTES

Harry Carriles was hired with funds from the Washington Unit Office on a Cooperative Education Agreement. Harry worked during spring 1980 on a Canada Goose project in the Flathead Valley. He will work summers 1980 and 1981 on Black/Grizzly Bear Interactions along the North Fork of the Flathead for his thesis project.

RESEARCH PROJECTS

Physiologic and Ecologic Studies of the Pronghorn (*Antilocapra americana*)

Project Leader: B. W. O'Gara
Cooperators: National Bison Range, U.S. Fish and Wildlife Service; Yellowstone National Park, U.S. National Park Service; and the Montana Fish, Wildlife and Parks Department

Objectives:

To study:

1. the reproductive physiology of male and female pronghorn;
2. the physiology and function of scent glands;
3. food habits related to changes in range conditions;
4. horn growth and casting; and
5. the relationship of pronghorns to other artiodactyls.

Results:

Work was continued on the pronghorn book, and two papers on related work were presented at the 9th Antelope States Workshop.

Population Studies of Canada Geese in the Flathead Valley

Project Leaders: J.J. Craighead and I.J. Ball

Objectives:

1. To gather current data on populations, nesting areas, and nest success of Flathead geese.
2. To compare the current situation with conditions documented during 1953-60.
3. To relate changes in reproductive output of the geese to changes in habitat or management strategies since the 1950's.
4. To prepare a monograph using both historical and current data.

Results:

Nesting surveys were conducted on Flathead Lake, the Flathead River from Polson to Paradise, and Ninepipe and Pablo Reservoirs.

A brief summary table of results follows:

Area	Total Nests (% Success) $\bar{X}$ 1953-1960	 1980
FLATHEAD LAKE		
Bird Islands	45	48
Narrows/Cat Bay Islands	30	10
West Shore Islands	56	46
North Shore	13	1
South Shore	1	0
FHL TOTAL	145 (64.5)	105 (80.0)
NINEPIPE RESERVOIR	10 (73.2)	59 (74.3)
FLATHEAD RIVER	46 (65.0)	24 (53.3)
STUDY AREA TOTAL	201 (65.0)	187 (74.3)

Exteremly low water levels prevailed in 1980, making generalizations from these data tenuous. However, local declines from earlier levels appear to be attributable to changes in habitat conditions on particular areas. We believe that data from one more field season would strengthen the study greatly and are attempting to secure funding for a final field season during April and May of 1981.

University of Montana Grizzly Bear Research Investigations

Investigator:	J. J. Craighead
Co-Investigator:	J. S. Sumner and J. Varney
Student Assistants:	J. Mitchell and G. Scaggs
Cooperators:	U.S. Forest Service; Montana Fish, Wildlife and Parks Department; Idaho, Wyoming and Alaska Departments of Fish and Game; National Rifle Association; National Geographic Society; Environmental Research Institute; University of Montana Foundation; Idaho Cooperative Wildlife Research Unit

Objectives:

1. To complete for publication with F. C. Craighead, Jr., a 15-year study of grizzly bears in the Yellowstone ecosystem and to encourage management agencies to utilize the research findings.
2. To develop a rapid, accurate, low-cost method of typing, mapping, and evaluating grizzly bear habitat utilizing LANDSAT imagery and computer-assisted analysis.
3. To continue studies of grizzly bears in the Lincoln-Scapegoat Wilderness Area in order to:
    a. determine relative bear numbers and relate this information to habitat use;

   b. quantify the amount, quality, distribution and seasonal fluctuations of three major plant foods used by grizzly bears.
4. To continue investigations of historic and present occupancy of the Selway-Bitterroot Wilderness by grizzlies and by using satellite-computer-assisted technology to determine the quality of the present habitat for possible re-introduction.

Results:

Not reported this Biannium.

River Preservation

Project Leaders:	J. J. Craighead and F. C. Craighead, Jr.
Assistant:	B. W. O'Gara
Cooperators:	University of Montana Foundation, Environmental Research Institute, U.S. Forest Service, and the National Geographic Society

Objectives:

1. To produce an educational lecture film on river preservation.
2. To assist federal, state, and private organizations to evaluate and classify rivers for inclusion in the National Wild and Scenic River System.
3. To promote the National Wild and Scenic River concept through publications and illustrated lectures.
4. To encourage student involvement in environmental issues related to river preservation and management.

Results:

Not reported.

Polar Bear Studies

Project Leaders:	C. Jonkel and B. O'Gara
Faculty Cooperators:	B. Pfeiffer, H. R. Fevold
Student Investigators:	G. Miller, S. Martin, B. Cushing
Cooperators:	Manitoba Department of Mines, Resources, and Transportation Services; the Polar Continental Shelf Project; Canadian Wildlife Service; Arctic Petroleum Operators Association; Northwest Territories Fish and Wildlife Service; Churhcill Northern Studies Centre; and U.S. National Science Foundation

Objectives:

1. To develop techniques for monitoring basic physiological responses to external stimuli and relate the results to behavioral responses; to develop studies of bear deterrent-attractant-aversive conditioning.

2. To study the various biological parameters of polar bears at select Polar Basin sites:
    a. Denning areas
    b. Migrations
    c. Feeding areas
    d. Food chains, currents, climatology, etc.
3. To study the ecology of various ice features deemed important to polar bears and develop a methodology for identification and mapping of such ice types.
4. Other studies as per the detailed, NSF research outline and subproject outlines.

Results:

Sandra Martin and Bruce Cushing completed their thesis. The summaries follow.

During the summers of 1978 and 1979, an investigation of polar bear habitat on the sea ice was conducted in Barrow Strait and adjacent channels of the Queen Elizabeth Islands, Northwest Territories, Canada. The area comprises the home range core of 1 sub-population of polar bears. The sea ice is the bear's primary habitat.

Field methods used from 20 May to 25 July 1978 were observation of the sea ice environment from 2 field camps established on island coasts, surveillance of sea ice by fixed-wing aircraft, and following polar bear tracks by helicopter. All basking seals, polar bears, sets of bear tracks, and the ice type each was sighted in were recorded on ice survey flights. Data collected from polar bear tracks followed by helicopter included activity of the bear, ice type, and direction of travel.

Four field camps were successively established between 19 May and 19 July 1979 in coastal sectors of Barrow Strait. The sea ice and its biota were observed from these camps. Previous research was used to choose 2 areas that were heavily utilized by polar bears and 2 areas that received light use.

Field work was similar at all 1979 study areas. The sea ice was surveyed every 1.5 hours. All basking seals were counted. Polar bears sighted in the areas were watched continuously. All other mammals and birds observed were recorded. Percentages of plant cover were estimated visually in 1 m^2 plots placed along transects on beaches adjacent to the sea ice under surveillance, and on the tops of cliffs above the beaches. The sea ice in a 10 sq mi (25 km^2) area was mapped using the ice classification scheme developed during this investigation.

Analysis of data collected during the 1978 aerial surveys found no strong relationship between numbers of polar bears and sets of bear tracks seen in the various ice types and the numbers of seals basking in those ice types. Many seals in a population could be using subnivean lairs constructed in snow drifts among rough ice, and would not be visible from aircraft. Therefore, polar bear use of different ice types may have reflected differential seal densities among these ice categories that were not evident from counting basking seals alone.

Habitat selection by some polar bears occurred in offshore areas of sea ice, as indicated by data collected during helicopter tracking in 1978. Consistent patterns of use relative to availability of ice types were not found in these data. The small sample size precludes conclusions being made, except to note that individual polar bears can show great variability in their selection of ice types over short periods of time.

Polar bears observed in all 3 1979 study areas in which they occurred exhibited habitat selection on the sea ice. Smooth ice was consistently used less than in proportion to its availability. The rough ice categories received expected amounts of use, or more than expected, based on the categories' availability.

Habitat selection for hunting alone was also examined. The relative levels of use of the ice types by hunting polar bears did not differ much from levels of use found when all activity was considered.

The numbers of polar bears observed in each of the 1979 study areas substantiated the high-low bear use dichotomy hypothesized before field work began. The 2 study areas receiving the most use by polar bears, Lowther Island and Erebus Bay, appeared to be the most biologically productive ecosystems of the 4 studied. These 2 held the greatest number of seals, the most numerous avian populations, and the adjacent beaches had the highest percent plant cover.

Two distinct regions were identified within the study areas; coastal ice and ice within major bays. Coastal ice areas receiving the greatest polar bear use had the greatest amounts of smooth ice, indicating greater stability. The bay receiving most use by polar bears had more diversity in ice types than the unused bays.

Polar bear behavior was classified in 5 broad categories: hunt, sleep, travel, feed, and play. The relatively low percent of time spent hunting by polar bears observed at the Dyke Ackland Bay study area (14%), and the great percent of total activity spent sleeping (58%) in this area, were influenced by the fact that a female bear with a cub-of-the-year killed and consumed a ringed seal there. The greatest relative amount of time spent traveling was recorded for the bears at Erebus Bay. This bay may lie on a heavily traveled route used by polar bears to cross from Wellington Channel to Lancaster Sound, and back.

The patterns of relative use of ice types exhibited among study areas were analogous to those patterns found in the relative availability of the ice categories. Comparisons of use of ice types by polar bears observed in 1978 and 1979 were essentially comparisons of offshore and coastal ice regions in the same geographic locale. Little difference was found between polar bear use of ice types in these 2 regions.

This investigation was conducted in summer, but the solid ice cover encountered during 1978 and 1979 was more typical of spring conditions in the Canadian Archipelago. Habitat most attractive to polar bears was a mosaic of ice types, where low and medium rough ice were interspersed with smooth ice. Large proportions of smooth ice in the mosaic indicated stability of the ice and thus prime habitat for the polar bears' main prey, the ringed seal. Another factor important to quality polar bear habitat is the biological productivity of an area. The primary productivity of an area will have an ultimate effect on the relative level of polar bear use an

area receives through its support of the food web. The polar bear is a top-level carnivore in these arctic marine food webs. Higher levels of primary productivity will provide a base trophic level for a more productive food web, and support greater amounts of use of an area by polar bears.

My study was an experimental investigation to determine what types of odors are possible attractants to the polar bear. Also studied were the responses of captive bears to the underwater vocalizations of the ringed seal, and the feeding techniques of bears. Captive polar bears were fed every 6 days. They were fed beef scraps, ringed seal, or beluga (white whale). When feeding, the bears held the food down with their forepaws and tore upwards with their head and necks in order to remove pieces of tissue. When eating seal or whale, the bears made extensive use of their incisors to expertly remove the blubber from the muscle tissue. Although the bears always consumed all the blubber from a portion of food before consuming the muscle tissue, there was no selective preference by the bears for pieces of food with blubber over those without blubber.

In 1979, the 2 captive bears displayed a strong positive response to recorded underwater ringed seal vocalizations, but no response to the other marine mammal vocalizations, except for a minimal response to the bearded seal vocalizations by Bear No. 3. This strong response to ringed seal sounds was similar to the bears' maximal response to seal scents. Based upon the strength of their responses to ringed seal vocalizations, and their lack of responses to the control vocalizations, I concluded that the bears were capable of recognizing and differentiating the underwater calls of their major prey species. Since polar bears possess the ability to recognize ringed seal calls, I believe that they probably utilize this ability when laying in wait for ringed seals at breathing holes, and that they thereby increase their chances of making a kill.

The odor attractant portion of this study was based on the premise that seal scents would elicit a definitive response from polar bears. The responses to seal scents were then to be utilized as a standard for determining the relative attractiveness of other scents. The strength of the responses by the captive and free-ranging bears confirmed this assumption, so that the responses of the bears to seal scents were used as a comparative standard.

In the laboratory portion of this study, only seal scents and menstrual odors elicited a maximal response from all 4 captive bears. In the field, seal and the other food scents were investigated and consumed the majority of the time. Used tampons were detected by scent 65.4% of the time. After detection, the bears tracked the scent to its source and the used tampons were then usually consumed. In both the laboratory and field, other animal scents and human blood were also presented to the bears. The responses to these scents were generally minimal to none. The lack of response to these other odors, combined with the positive responses to menstrual odors, clearly demonstrates that menstrual odors attract polar bears, and, further, that it is some aspect peculiar to menstrual blood which elicites

this attraction. My conclusion means that more must be done to warn, and possibly protect, women who venture into bear habitat during their menstrual period.

Finally, the field results also indicated that free-ranging polar bears are attracted by potential food and pseudo-food scents. This indicates that more time and effort needs to be invested in investigations aimed at determining possible bear attractants. Bear attractants could thereby be reduced or removed from areas where bear/Man conflicts are possible, which in turn should reduce the numbers of bears entering man's environment.

An Investigation of Elk-Cattle Relationships on Elk Winter Ranges of the Crazy Mountains, Montana

Project Leader:	J. T. Harris
Student Investigator:	M. Wunder
Cooperator:	U.S. Forest Service

Objectives:

1. To estimate the combined elk and cattle carrying capacity of the elk winter range;
2. to determine how increasing elk numbers will affect cattle grazing on National Forest Lands;
3. develop an option oriented plan to suggest relative elk and cattle numbers, including possible management actions to achieve and maintain desired population levels; and
4. suggest locations for permanent indicator transects, plots and or exclosures to monitor winter range vegetation changes.

Results:

The student investigator completed his thesis. The summary follows.

Because the number of elk in the Crazy Mountains was increasing, U.S. Forest Service administrators were concerned that competition between elk and cattle would develop. As a result, I was hired to conduct a study of the elk winter range to determine if a problem existed, and if so, what should be done about it. During the spring and summer of 1978, data were gathered concerning pellet-group distributions, range condition and trend, and forage utilization by cattle on 17 preselected key areas. Area ranchers were also surveyed to get their opinions on the elk situation in the study area. In 1979, I made several trips to the Mountains to gather more data on pellet-group distributions and habitat use by cattle.

Elk pellet-group densities were generally greater than the 0.39 per 40.5 m^2 plot required for classification as key elk winter range by Forest Service standards. Densities declined significantly ($p \leq 0.05$) from 1978 to 1979 on most key areas in the northwest. Along the east front of the Mountains, no consistent trend was

observed. Elk pellet-group densities were significantly ($p \leq 0.05$) greater on the upper than the lower parts of the slopes in the northwest and east front during both years.

Densities of cattle droppings were generally lighter and more consistent between key areas than elk pellet-groups. As with elk, cow droppings declined significantly ($p \leq 0.05$) from 1978 to 1979 in the northwest but not along the east front. Cattle use was concentrated along the lower parts of the slopes, but only in the northwest during 1979, was the difference significant ($p \leq 0.05$).

Deer pellet-group densities were more variable between areas but less between years. This indicated that deer concentrated in certain areas and used them consistently from year-to-year. As with elk, deer pellet-groups were concentrated on the tops of key-areas but the difference was not significant ($p \leq 0.05$).

All of the key areas had a fair or good range condition. The site potential, however, is probably low enough that these areas have relatively good or excellent condition. The trends in condition were almost all positive or static, suggesting that neither cattle nor elk have harmed the range. Soil was in good or excellent condition and the trends were mostly upward.

Forage utilization by cattle in 1978 was light, usually less than 20%, on all of the key areas. The most intensive grazing occurred on BFMRI where only 26% of the weight of all bunchgrasses was removed. Utilization was significantly ($p \leq 0.05$) concentrated on the lower parts of the slopes in all parts of the study area. The distribution of cattle in the northwest during part of 1979 showed a preference for north to east slopes and they seemed to avoid the key areas.

The landowner survey pointed out that most of the ranchers wanted the same number or fewer elk in the Mountains. They were generally amenable to either-sex elk hunting to control the population. Most elk damage occurred in the northwest where elk have been present the longest. Access to the Mountains is limited but still available to sportsmen.

At present population levels, elk and cattle do not compete for forage in the study area. Based on the distribution of pellet-groups and cow droppings on slopes, spacial segregation is the primary factor ameliorating competition. This is reinforced by the distribution of cattle and the amount of forage that I observed late in the winter of 1978-79.

The Montana Department of Fish, Wildlife, and Parks has decided to reduce the herd in the northwest and let the population grow along the east front. Because of this decision, little other management should be needed. If the elk population or livestock numbers increase, cross-fencing may be needed to distribute cattle grazing more evenly throughout the Comb Butte grazing allotment. To improve the asthetics of elk hunting a walk-in hunting arrangement in the northwest would be desireable.

Causes of Low Pronghorn Fawn:Doe Ratios on the Sheldon National Wildlife Refuge, Nevada

Project Leader:	B.W. O'Gara
Student Investigator:	M. McNay
Cooperators:	U.S. Fish and Wildlife Service; Nevada Department of Fish and Game; National Rifle Association

Objectives:

1. To examine the causes and degree of pronghorn fawn mortality.
2. To evaluate the condition of newborn fawns as an indicator of their dams' nutritional status, and thus, indirectly, the adequacy of the range for pronghorns.
3. To evaluate the adequacy of fawn bedding sites and the impact of cattle on those sites.

Results:

The student investigator completed his thesis. The summary follows.

During 1978 and 1979, the causes of low pronghorn fawn recruitment were investigated on the Sheldon National Wildlife Refuge in northwestern Nevada. Thirty-four fawns were monitored with the aid of radiotelemetry equipment.

During 1978, only 3 sets of twins were observed and 8 of the 13 captured fawns were singles when captured. During 1979, only 5 of 21 captured fawns were singles when captured. The estimated fawning period, 12-24 May, was earlier than those reported by other workers in similar areas. Cold, wet weather during the 1978 fawning period may have contributed to the undocumented, but apparently high, mortality of neonates. Fawns captured in 1978 were smaller and lighter than those captured in 1979, possibly reflecting the relative condition of does during the two fawning periods. The rate of predation was higher on healthy fawns than on sick or weakened ones, indicating that, in areas of heavy predator pressure, selection may favor inactive fawns.

Coyote predation was the major proximate cause of natural mortality, claiming 41% of the marked fawns. In addition, 3 unmarked fawns were killed by coyotes while under observation by capture crews. One eagle kill was the only other documented source of predator-induced mortality. Three fawns probably died as an indirect result of handling. Accidental and death from undetermined causes accounted for the remainder of the mortality. Total mortality, excluding deaths related to handling, was 63%, and 90% of it occurred during the 1st 3 weeks.

July through October precipitation and fawn recruitment data were analyzed for 1955 through 1967. A significant positive correlation existed between fawn survival and late summer precipitation during the previous year. That correlation was probably related to late summer forage condition and, in turn, to the condition of does going into the winter.

Blood samples were collected from 17 fawns during 1979. A comparison between blood parameters from Sheldon fawns and those collected by Barrett (1978) in Alberta revealed a number of significant differences. Lower energy intake in the Nevada fawns was indicated by the significantly lower red blood cell and calcium values and the higher mean corpuscular volume, mean corpuscular hemoglobin, and mean corpuscular hemoglobin concentration values. Blood urea nitrogen and total protein values were similar in both populations indicating protein intake was similar.

Two potentially pathogenic bacteria, Pseudomonas spp. and Streptococcus spp., were collected from throat and rectal swabs taken from captured fawns in 1979. None of the mortality was attributed to disease, but respiratory problems in newborn fawns was common and probably related to infection by those pathogens.

Compared to control sites, bed sites were characterized by significantly lower vegetative cover and volume on the Bed Plot and significantly higher cover and volume within 0.3 m of the Bed Plot. Compared with bed site measurements from other areas, the Sheldon sites had lower cover and volume values, suggesting bed cover is suboptimal on the Sheldon. Past abuse by livestock was responsible for deterioration of the range, and future management should be aimed at increasing the overall plant height, density, and diversity on fawning areas.

Pre- and post-parturient pronghorn does avoided cattle and horses, and major fawning areas were located peripheral to cattle or horse concentrations. The shift in fawning areas between 1978 and 1979 on the Mule Mountain area was probably due to the presence of cattle on the "traditional" fawning ground during 1979.

Spring diets of cattle and pronghorns were determined from fecal analyses in 1979. Diet overlaps on shrub-grassland ranges were less than 3%. Diet overlap on the Bald Mountain Lake playa was 7.3%. Range transects, run concurrently with fecal sampling, indicated that pronghorn food items preferred in other studies were available and abundant, but their abundance was not reflected in the fecal analyses. A potential competition problem existed on the dry lake beds in late summer when succulent forage became available, attracting both cattle and pronghorns.

Population trends since 1955 were evaluated. No overall trend existed but a significant, yet small, upward trend was found for the 12 year period, 1955-1966, when intensive predator control was practiced. Significantly higher fawn recruitment existed during years of predator control, but average fawn recruitment was still low relative to some other pronghorn populations. The past response of the pronghorn population to predator control combined with the current ban on predicides, suggested future predator control efforts would be expensive and probably would not result in a significant increase in total population numbers.

The Effects of Human Disturbance on Great Blue Heron Colonies in Northwestern Montana

Project Leader:	B.R. McClelland
Student Investigator:	J. Parker
Cooperators:	The Confederated Salish and Kootenai Tribes

Objectives:

1. To assess the impact of logging, wetland drainage, damming, and other human activities on the reproductive success of Great Blue Herons.
2. To conclude the 1969-70 field work of Dennis Billings, by summarizing his data on food habits and pesticides, and by comparing the locations of northwestern Montana heronries and their breeding successes in 1969-70 with those of 1978-79.
3. To determine the necessary components of Great Blue Heron habitat in northwestern Montana, and provide guidelines for management of this habitat.

Results:

The student investigator completed her thesis. The summary follows.

Great Blue Herons in northwestern Montana nested primarily in stands of old-age cottonwoods in riparian bottomlands, but they were also found in drier, coniferous sites on the Flathead and Swan rivers. Nest trees had a mean dbh of 71 cm and a mean height of 27 m. The average colony size was 0.53 ha, or 26 nests. Sixty percent of the nests in the study area were active or used by breeding adults, and 83% of the breeding pairs were successful in fledgling young. The mean fledgling success was 1.88 young per active nest, or 2.25 young per successful nest. Many other bird species in the colonies were tolerated by the herons, although several interspecific conflicts were observed.

Colonies were on the average 70 m from the water, 0.62 km from the nearest road, and 0.71 km from housing. The number of nests in a colony correlated well with the distance from roads, decreasing with proximity to roads. The active colonies were significantly farther removed from the river than were the inactive colonies. Housing did not affect colony size or activity.

The number of herons in the study area grew 10-15% between 1969 and 1979. The mean colony size decreased in the same period, primarily because of a large increase in the number of small colonies. The life-span of colonies in northwestern Montana was 5-15 years, with the smaller colonies being shorter-lived.

Inventory and Analysis of the Range and Wildlife Resources, Wildhorse Island, Flathead Lake, Montana

Investigator:	L. Eddelman
Student Investigator:	D. Kautz
Cooperators:	Montana Fish, Wildlife and Parks Department, Nature Conservancy

Objectives:

To provide baseline data on the Island range and wildlife resources in order to evaluate, classify, and manage such resources relative to present and future goals and objectives. The inventory shall be aimed at total Island ecology rather than emphasizing specific factors pertaining to particular wildlife species.

Results:

Wild Horse Island lies near the center of the Big Arm embayment of Flathead Lake in northwest Montana. In early 1978, the Island became a state park under the jurisdiction of the Montana Department of Fish, Wildlife and Parks. The primary purpose of this study, conducted from July 1978 through July 1980, was to provide the needed baseline data on which management and development alternatives and decisions may be based. Following the introductions of bighorn sheep (*Ovis canadensis*) in 1939 and mule deer (*Odocoileus hemionus*) in 1940, and during a period of intensive horse (*Equus caballus*) ranching from 1943 to 1956, the number of ungulates on the Island increased tremendously. In the summer of 1953, 83 bighorn sheep and lambs, 300-400 mule deer, and 100 horses and colts were estimated inhabiting the 876 ha (2165 acre) Island. Severe overutilization of the native forage resource and deteriorated range conditions resulted, promoting the widespread increase of introduced, mostly weedy, vegetation. Today, cheatgrass (*Bromus tectorum*) and Kentucky bluegrass (*Poa pratensis*) communities occupy greater than 65% of the Island grassland; approximately 20% of the 280 species of vascular plants found on the Island are introduced Eurasian weeds and cultivated forage plants. Shrub cover and ponderosa pine (*Pinus ponderosa*) regeneration is appreciably reduced in the forest. One endangered plant species, Spaulding's silene (*Silene spauldingii*) also inhabits the Island. Island topography, soils, range sites, existing vegetation, potential climax vegetation, and existing range conditions have been classified, described, and mapped. Mapping was done on a 1978 aerial photograph of the entire Island enlarged to approximately 1:6150 (10.2 inches/mile). In 1978 and 1979, only 8 species of mammals (not counting the bats) inhabited the Island; mammal diversity was greater historically. A total of 102 species of birds were observed on and around the Island during this study. Species of particular interest that nested on the Island included the Bald Eagle (*Haliaeetus leucocephalus*), Goshawk (*Accipiter gentilis*), Red-tailed Hawk (*Buteo lineatus*), Osprey (*Pandion haliaetus*) and Prairie Falcon (*Falco mexicanus*). The completed thesis will also include an analysis of potential management alternatives, including the use of fire and native species plantings to promote improved range conditions. Management recommendations will also be made.

A Study of Bighorn Sheep on Upper Rock Creek, Granite County, Montana

Project Leader: B. W. O'Gara
Student Investigator: T. Butts
Cooperators: Bureau of Land Management; Montana Fish, Wildlife and Parks Department

Objectives:

1. To determine herd size and composition and ewe/lamb ratios; and
2. to identify specific ewe/lamb habitat areas and movement paths and patterns.

Results:

The student investigator completed his thesis. The summary follows.

A die-off decimated a native population of bighorn sheep in the upper Rock Creek Drainage, Granite County, Montana, during the late 1960's. A reintroduction of 31 sheep, including 19 collared ewes, was made in early 1975 by the Montana Department of Fish and Game. A study to estimate the population size, sex and age composition, group size, group fidelity, seasonal key use areas, home range size, and movements, was conducted between April 1977 and mid-August 1978.

The population had increased to approximately 100 by June 1978. Ewe/lamb ratios were estimated at 100:71 and 100:77 in June 1977 and 1978, respectively. Mortality was low. Mean group size was 10.2. Eight of 10 2-year-old ewes gave birth to lambs in 1977. No indication of twinning was observed.

The sheep were apparently expanding their range annually. The rams used a winter range with other sheep, then moved to a separate late-winter range in February. They migrated 11 and 17 km between winter and summer range in 1977 and 1978, respectively. Ewes began lambing in mid- to late-May. Most lambing grounds were steep, cliffy areas within 4-6 km of the winter range, though a small group of ewes migrated 16 km to lamb. Summer ewe range appeared to be a horizontal expansion of the winter range, rather than a completely separate range.

Seasonal mean standard diameters for collared ewes in 1978 ranged from 0.4 km during lambing to 1.9 km after lambing. Home range sizes for ewes averaged 380 ha. Seasonal mean cohesion coefficients were low, ranging from 0.11 to 0.35, indicating frequent interchange of individuals between groups.

Rapid horn development, low mortality, lambing by 2-year-old ewes, and high natality rates indicated a high quality bighorn sheep population. Management recommendations included: (1) commence a limited specific-sex, permit only harvest in 1980; (2) a season length of no more than 6 weeks, ending no later than 1 November; (3) keeping herd numbers between 200-230 sheep to prevent range damage, yet insure no inbreeding; (4) careful monitoring of natality and survivorship, particularly of lambs; (5) monitoring range condition and trends on crucial grasslands; and (6) careful impact assessment before developing mineral or timber resources.

Numerical Response of Woodpeckers and Their Effect on the Mortality of Mountain Pine Beetles in Lodgepole Pine in Northwestern Montana

Project Leaders:	B. R. McClelland, H. Lowe
Student Investigator:	A. Lester
Cooperators:	McInntire Stennis, University of Montana School of Forestry; National Park Service, Glacier National Park

Objectives:

1. To determine densities of woodpeckers and mountain pine beetles (Dendroctonus ponderosae) in areas of endemic and epidemic beetle populations.
2. To assess woodpecker-caused mortality of mountain pine beetles.
3. To characterize active woodpecker nest trees and relate the findings to forest management practices.

Results:

The student investigator completed her thesis. The summary follows.

Relationships between 5 woodpecker species and an epidemic population of mountain pine beetles (Dendroctonus ponderosae) were studied in lodgepole pine (Pinus contorta v. latifolia) forests of northwestern Montana from March 1978 through September 1979. Downy (Picoides pubescens), Hairy (P. villosus), Northern Three-toed (P. tridactylus), Black-backed Three-toed (P. arcticus), and Pileated (Dryocopus pileatus) Woodpeckers were observed nesting in the study area and feeding on the beetles. High total densities of feeding woodpeckers were 57.3 woodpeckers per 100 acres (40 ha) in the 1977-78 winter and 34.4 woodpeckers per 100 acres (40 ha) in the 1978 breeding season. The highest nesting density was 14.3 pairs per 100 acres (40 ha) in the 1979 breeding season. Northern Three-toed and Hairy Woodpeckers were the most abundant species in the study area. Nine of 11 Northern Three-toed nests were in lodgepole snags that had heartwood decay at the nest holes. One of 8 Hairy nests was in a lodgepole snag; the remaining 7 nests were in aspen or birch. All Hairy nest trees had evidence of heartwood decay. The relative scarcity of nest sites for Hairy Woodpeckers probably prevented a large increase in their numbers in response to the beetle epidemic. Because of their ability to nest in lodgepole pine, the most common tree species in the study area, Northern Three-toed Woodpeckers responded numerically to the beetle epidemic. Feeding woodpeckers disturbed about 10% of the bark on lodgepole attacked in 1978 by beetles. This contributed to overall beetle mortality of 96-97%, but woodpecker feeding did not appear to exert a regulating effect on the epidemic beetle population. Severe winter and summer weather conditions probably were the most important factors in causing high beetle mortality.

A Survey of Ungulates in the Rattlesnake Creek Drainage

Project Leader:	B. W. O'Gara
Student Investigator:	P. McBride
Cooperators:	U.S. Forest Service; Montana Fish, Wildlife and Parks Department; Montana Power Company Friends of the Rattlesnake

Objectives:

To determine the relative numbers, habitat relationships, and seasonal distributions of ungulates in the Rattlesnake Creek Drainage.

Results:

The student investigator has completed her thesis, and the summary follows.

A survey of ungulates in the Rattlesnake Creek Drainage was conducted between June 1977 and April 1979. Browse transects, observations, and pellet group counts indicated numbers and use by elk and deer on 3 winter ranges. Scent post lines, hunter checking stations, and pellet counts helped determine elk and deer use on 4 summer ranges. Potential mountain goat habitat in areas where goats had previously been sighted were surveyed for goats and their sign.

Pellet counts slightly overestimated elk and deer numbers on winter ranges compared to the numbers obtained by direct observations. Neither pellet counts or observations could accurately estimate numbers of cervids using winter ranges but relative abundance was indicated.

Use by elk and deer varied greatly between winter ranges, depending on the amount and type of available food and the amount of security and thermal cover present. Deer and elk numbers had decreased on the Grant Creek Ranch, but had apparently stabilized during the last few years. The principle cause for this decrease, especially for deer, was assumed to be a shortage of quality browse. Strawberry Ridge was used almost exclusively by deer. The winter deer population was stable but browse production has probably decreased primarily because of encroachment and overutilization (to the point of decadence) of preferred browse species. Elk Ridge was primarily used by elk. A small population of deer also used the Ridge during winter. Elk were favored on the Ridge because much of it was covered by mature timber and open grassy slopes. Browse was scarce but what was available was only moderately used.

Potential migration routes from the Grant Creek winter ranges to summer ranges were surveyed for elk and deer use on both sides of Grant Creek. The east side route was used by elk and deer and led into the Rattlesnake Drainage. The west side route was used primarily by deer and led farther north in the Grant Creek Drainage.

Use of one pair of summer ranges, the High Falls Drainage and a clearcut, was apparently much greater than on the other 2 summer

ranges, Shoofly Meadows and the McLeod Peak Range. However, pellet counts may have underestimated use in the latter 2 moist ranges. Soft summer pellets probably decomposed faster in those moist sites than on the drier High Falls and clearcut sites. Elk tended to use mature timber stands and deer used more open, brushy areas. Apparently, only deer used the clearcut site.

I never saw mountain goats during this study, but goats wintering in the Grant Creek Drainage and summering along ridges between the Grant and Rattlesnake Creek drainages were seen by others. Goats had wintered on steep ledges in the Rattlesnake Drainage but that area is no longer used.

Subdivisions on winter ranges will undoubtedly reduce the numbers of elk and deer that can use an area, but if properly planned, some reduction can be avoided. Primary concern must be preservation of critical feeding and security areas, migration routes, and strict dog control.

Many potential recreationalist-wildlife conflicts, especially on winter and spring ranges, can be avoided by educating the public to the harm done to deer and elk by harassment. Peer pressure to eliminate deliberate harassment is also needed. Most wild animals can become habituated to people if human use of an area is gradually introduced and not associated by the animals with alarming events. Again, control of dogs, especially on winter and spring ranges, is of utmost importance.

Hunting pressure in the Rattlesnake Creek Drainage could be increased to help lower deer populations on overutilized winter ranges. An either-sex season would help to lower deer numbers better than a buck-only season. An increased take of elk probably would not adversely affect the herds. Mountain goats, no longer hunted in the Drainage, could be transplanted into the area where suitable year-around habitat is available.

Food Habits, Health, Population Dynamics, and Hunter Impact on the Middle Fork Elk Herd, Flathead Drainage, Montana

Project Leader:	B. W. O'Gara
Student Investigator:	D. Daneke
Cooperators:	Montana Fish, Wildlife and Parks Department, the Flathead National Forest, and the National Rifle Association

Objectives:

1. To determine the seasonal food habits and report the abundance and importance of each item;
2. to determine the quality of key winter browse species;
3. to determine the herd's age structure;
4. to determine the calf production levels; and
5. to determine the effect of hunting on population characteristics.

Results:

The student investigator completed his thesis. The summary follows.

Population structure and dynamics, the influence of hunting on the elk population, and the relationship between accessibility and hunting comprised the demographic aspect of this research. Habitat-oriented aspects included seasonal food habits, range condition, and forage quality on the Middle Fork range.

The study area consisted of the Great Bear Wilderness, Flathead National Forest, Montana, and surrounding lands. Data collection began on 1 January 1978 and ended on 1 April 1980.

Sex ratios were determined by ground and aerial surveys. Averaging the data from both types of surveys indicated 27 males: 100 females in 1978 and 16:100 in 1979.

Production estimates were derived from field surveys, hunter interviews, and Montana FWP aerial trend counts. The aerial trend counts were used as minimum late fall production levels. Consequently, the 22 calves:100 cows obtained from this source was considered the pessimistic estimate. The field surveys were thought to produce over-estimates, and the resulting 37 calves:100 cows was labeled as optimistic. The mid-value from all data was 28 calves:100 cows and was used as a conservative estimate.

Hunting accounted for 91% of all documented mortality. The mean age of hunter-killed elk was 3.4 years, and the mean age of natural mortalities was 5.5 years. Sample sizes were small.

The population dynamic was calculated by standard life table methods for the projected long-term trend. A short-term prediction was derived by arithmetic means. Age structure was determined from ages of hunter-killed elk. Fecundity was determined from the production estimates. Trends were predicted for 3 levels of fecundity and 4 possible current population trends (assumed λ).

When λ was assumed to be 1.0 and fecundity was determined for 37 calves:100 cows, the calculations indicated the population would decline 0.4% during the next year and 0.3%/year over the long term. Setting assumed λ equal to 0.9 and 1.1 indicated the population would change -12.1%/year and +9.0%/year, respectively.

Using the pessimistic production estimate (22:100), and assuming $\lambda = 1.0$, the long-term rate of population change was -8.2%/ year and the short-term estimate was -7.7%/year. The extreme possible rates of population change were -18%/year and +2%/year.

At the conservative production level (28:100) and assumed $\lambda = 1.0$, the long-term rate of change was -5%/year and -5.1% over the next year. These were probably the best estimates for this population. Extreme estimates were +5%/year and -15%/year.

Calculations were based on a smoothed age structure, but using the unsmoothed structure produced negligible change in results.

A life table based on a mortality schedule was also constructed. Results indicated a 5% increase in the rate of decline over rates calculated by the survivorship schedules.

Data used to determine the influence of hunting on the elk population, and the influence of accessibility on hunting patterns, were collected by hunter interviews. Elk appeared to congregate in moderately accessible areas. The number of hunter days increased

exponentially with increasing accessibility. However, hunter success decreased with increasing levels of accessibility.

Hunter success increased with increasing apparent elk density. However, the slope of the regression line (0.36) indicated that a slight decrease in hunter success accompanied a relatively drastic decrease in apparent elk densities. The conclusion was that hunter success was an insensitive measure of apparent elk density.

Susceptibility of elk to hunting was calculated as 7.8% of the theoretical maximum. The highest degree of susceptibilities were found in the least and most accessible areas.

Median distances of kills from roads and trails were 1.4 and 0.2 miles (2.2 and 0.3 km) for 1978, and 1.2 and 0.5 miles (1.9 and 0.8 km) for 1979.

Food habits were determined by back-track surveys, fecal analysis, and feeding site surveys. Forty-six taxa were identified as elk forage. Each year was segregated into 6 seasons and the food habits for each were described. The starting and ending dates of each season were determined by climatological conditions.

When data for both years were combined, conifers were the predominant winter forage. During spring and summer, forbs predominated the diet, and shrubs dominated the diet throughout the rest of the year. The 10 most frequently utilized genera in decreasing order of frequency were Salix, Lupinus, Abies, Berberis, Carex, Pseudotsuga, Physocarpus, Shepherdia, Agropyron, and Poa. The 10 most consistently reported taxa in decreasing order were Salix, Carex, Abies, Berberis, Poa, Physocarpus, Shepherdia, Composite, Lupinus, and Potentilla.

Populus spp. (cottonwood) was the most digestible browse tested by in vitro analysis. Cornus stolonifera (red osier dogwood) was the least digestible. All browse species tested showed relatively low levels of digestibility.

Browse production and quality appeared inadequate to prevent severe weight loss except during the mildest of winters.

Management recommendations were designed to increase the nutritional plane of the herd, improve hunting quality, and temporarily decrease hunting mortality on cows after habitat improvement is initiated.

The Influence of Logging and Wildfire on Grizzly Bear Habitat in Northwestern Montana

Project Leader:	C. Jonkel
Student Investigator:	P. Zager
Cooperators:	USDA Forest Service; U.S. Fish and Wildlife Service; Montana Department of Fish, Wildlife, and Parks; University of Montana

Objectives:

1. Assess the similarity between plant communities created

by wildfire and those created by different logging and slash disposal methods with respect to grizzly bear plant foods.
2. Determine the kind and amount of grizzly bear utilization of logged areas and burned sites.
3. Determine grizzly response to an open, traveled road system.
4. Determine grizzly habitat "preference" and "avoidance" patterns.

Results:

The student investigator completed his thesis. The summary follows.

The grizzly bear (Ursus arctos L.), south of Canada, was classified as a "threatened" species under the Endangered Species Act of 1973. The impact of wildfire suppression, logging, and other land management activities on grizzly bears and their habitat are largely unknown. Therefore, logging and wildfire effects on grizzly bear habitat in northwestern Montana were studied in conjunction with the University of Montana's Border Grizzly Project from 1977 through 1979.

The vegetation on 330 sites known to be used by grizzlies was sampled. The response to disturbance of grizzly plant food species was determined by comparing individual species' constancy/coverage values on disturbed sites with relatively undisturbed, old-growth sites. Overall, the canopy cover of the shrubs considered key grizzly foods was higher on sites burned by wildfire 35-70 years ago than on comparable sites supporting old-growth timber. The canopy cover of these species was generally less on clearcut sites where the slash was bulldozer-piled than on burned sites. The key shrub response on clearcut sites where slash was not treated was intermediate; a few key shrubs increased in cover, while others declined. Forb response to disturbance was erratic; graminoids generally increased following disturbance. Site treatment is at least partially responsible for this differential response; bulldozer-scarification apparently destroys the vegetative propagation organs of these shrubs.

Grizzly habitat utilization patterns were intensively studied during the 1979 field season. Grizzlies preferred snowchutes, ridgetops, and creek bottoms during the spring; they preferred shrubfields, slabrock, ridgetops, and creek bottoms during the summer/fall. Cutting units and habitat affected by open, traveled roads were avoided throughout the active season.

Cutting units that were utilized by grizzlies were

generally isolated from human disturbance factors and provided proximate cover (within 50 m) in the form of well-developed shrub strata, "leave trees", and cutting unit borders. Management implications of the study are discussed.

Forage Selection and Habitat Use of the Sumatran Rhinoceros in Malaysia

Project Leader:	B.W. O'Gara
Student Investigator:	R. Flynn
Cooperators:	Malaysia Department of Wildlife and National Parks, World Wildlife Fund International

Objectives:

1. To determine the kinds, relative amounts, and characteristics of forage selected by the Sumatran rhino (Dicerorhinus sumatrensis) in the Endau-Rompin area of southern Penisular Malaysia.
2. To describe the habitats used by the rhino, especially at feeding sites.

Results:

Information collected during the 1979 field season was evaluated and plans made for the 1980 trip. The rhinos were found to forage on the leaves and stems of a wide variety of juvenile tropical rain forest trees. From 89 samples, 34 plant families and 49 genera were identified. Most rhino feeding was located along small streams, above 300 m in elevation, and in closed-canopy primary forest. The crude protein content of the food plants was significantly higher than a control, but phosphorus was much lower.

The student investigator will return to Malaysia in July to gather additional information on this rare Asian rhino.

A Study of Social Organization, Social Behavior, and Population Dynamics in Rocky Mountain Bighorn Sheep on the National Bison Range, Moiese, Montana

Project Leader:	D. Jenni
Student Investigator:	J. Hogg
Cooperator:	National Bison Range

Objectives:

1. To compile a quantitative catalog of the frequency of occurrence and the social context of selected behavioral acts, with special emphasis on behavior during rut and lambing;
2. to quantitatively characterize social organization using the following parameters: group size, group sex ratio, group age structure, dispersion of groups and individuals

with groups, relative group movement;

3. to determine the number of ewes bred, the survivorship of lambs and the causes of mortality in lambs;
4. to initiate the construction of a current or cohort life table and to identify causes of mortality in yearlings and adults.

Results:

The student investigator is in the field for his second field season. The study will continue until 1982.

A Study of an Introduced Mountain Sheep Herd near Paradise, Montana

(Replaces: A Study of an Introduced Mountain Sheep Herd in the Petty Creek Drainage, Montana)

Project Leader:	J. Harris
Student Investigator:	L. Kopec
Cooperators:	U.S. Forest Service; Montana Fish, Wildlife, and Parks Department

Objectives:

1. Locate and map seasonal ranges and movements.
2. Census the herd.
3. Assess productivity.
4. Compare general health and vigor to the Wildhorse Island herd.
5. Make management recommendations regarding possible habitat manipulation and future harvest.

Results:

Efforts to capture sheep in Petty Creek failed, and the study area has been moved.

In January 1979, 41 bighorns were transplanted from Wildhorse Island in Flathead Lake to the Cut-off area near Paradise, Montana. The herd increased to 50 sheep by spring 1980. Presently, 5 sheep are outfitted with radio collars, and about 15 others are marked with neck bands or rope collars.

No distinct migrations from winter to summer ranges have been noted. Seasonal movements are confined to an expansion of the winter range as snow recedes and a movement of ewes to lambing cliffs in early May.

The April ewe:lamb ratio was approximately 100:50. About 20 lambs were born during May, 1980. Some 2-year-old rams have immigrated to the Cut-off area from a nearby herd. The current population estimate is around 70 sheep.

Pellets were collected in early April for lungworm analysis. Browse transects in Fourteen Mile and Squaw Creeks were read in early May.

Summer field work will include intensive habitat mapping, trapping, and telemetry work.

Ecological Study of American Marten in Glacier National Park, Montana

Project Leader:	B.R. McClelland
Student Investigator:	G. Burnett
Cooperators:	U.S. Fish and Wildlife Service, U.S. National Park Service, University of Montana

Objectives:

1. To investigate fluctuations in a marten population and its prey base.
2. To document marten movements and activity patterns.
3. To describe habitat use by resident and dispersing marten.
4. To propose long-term management guidelines for marten habitat in spruce-fir habitat types in western forests.

Results:

Between 5 June and 15 October 1979, 24 marten were live-trapped on a 15.6 sq. km area in the West Lakes District of Glacier National Park, Montana. Trapped marten were fed and watered, ear-tagged, and weighed; sexes and ages were determined; general condition, behavior, and breeding condition were also recorded. Eleven marten were radio collared between 2 August and 15 October. Over 170 sighting/locations were made of collared marten. When a marten was located, its behavior, proximity to vegetation, and weather conditions were recorded. In addition, the habitat type, cover type, and cover class (logs, shrubs, grasses, forbs, soil/litter, and rocks), aspect, slope, horizontal configuration, and topography, were recorded. Small mammals were trapped in 5 plots to index the relative abundance of prey in different cover types. Snow quality and quantity, depth of marten tracks, hunting sites, and travel routes were described for winter months.

As of 16 May 1980, all transmitters had failed. An attempt is being made to retrap collared marten, to retrieve as many radios as possible. One collar has been removed.

The study area will be habitat typed during June/July; trapping will be conducted on 7 small mammal plots to provide an index of the spring prey population. Commercial trapping records for marten taken in northwestern Montana will be summarized and related to forest types.

Field work will be completed in September 1980.

Black Bear Ecology and Management in the Northern Conifer-Hardwood Forests of Maine

Project Leaders:	C. Jonkel and L. Pengelly
Student Investigator:	R. Hugie
Cooperators:	Maine Department of Inland Fisheries and Wildlife, University of Montana, University of Maine, National Rifle Association, Penobscot Valley Conservation Association, Border Grizzly Project

Objectives:

1. To determine black bear habitat and its use by bears in Maine.
    a. Describe available habitat in terms of cover types, topography, current use, and road networks.
    b. Describe bear distribution and movements in available habitat.
    c. Describe patterns of black bear behavior such as seasonal activity, sex and age similarities in movements, and how bears relate to human activity within their range.
2. To describe how black bear habitat can be perpetuated.
    a. Describe the effects of forest practices, fire, and other activities on bear habitat.
3. To describe the basic biological characteristics of black bears on the study area.

Results:

The student investigator is completing his dissertation. The summary should appear in the next Biannual Report.

Winter Habitat Selection and Movement of Elk (Cervus elaphus) in the Drainage of the Middle Fork of the Flathead River, Montana

Project Leader:	B.W. O'Gara
Student Investigator:	M. McDonald
Cooperators:	Montana Fish, Wildlife, and Parks Department; Flathead National Forest

Objectives:

1. To describe and determine winter habitat type and use.
2. To determine seasonal migratory routes via monitoring of radioed and collared elk.

Results:

The student investigator is working for a consulting firm and writing his thesis. The summary should appear in the next Biannual Report.

The Effects of Hunting on a Mountain Lion (Felis concolor) Population in Western Montana

Project Leaders:	B. W. O'Gara and K. G. Greer
Student Investigator:	Kerry M. Murphy
Cooperators:	U.S. Forest Service; Montana Department of Fish, Wildlife and Parks

Objectives:

1. To examine age structure, density, natality, and the distribution of mountain lions in hunted and unhunted drainages of the study area.
2. To investigate hunting pressure and harvest of mountain lions in the study area, and relate those data to population characteristics.
3. To determine timing and distance of dispersal by young animals and the age of sexual maturity in males.
4. To identify and describe winter habitat requirements of mountain lions in the study area, specifically those relating to the aquisition of prey.

Results:

Work was initiated in the Fish Creek drainage during December 1979 and continued through April 1980. Lions were treed on 14 occasions; 5 adults were instrumented with radio transmitters and one kitten was ear-marked. One bobcat was instrumented in cooperation with state furbearer studies. Twenty-seven radio relocations have been obtained to date.

The known lion harvest from the Fish Creek drainage consisted of single, unmarked male and female lions and one radio-collared male. At least ten mountain lion tag holders hunted in the study area during the 1979-80 season. Details of their hunts will be determined in telephone interviews.

Fieldwork will continue in both the 1980-81 and 1981-82 winter periods. The thesis will be completed by June 1982.

Pronghorn Antelope Behavior in Northwestern Nevada - Southeastern Oregon

Project Leader:	B. W. O'Gara
Student Investigator:	J. O. Meeker
Cooperator:	U.S. Fish and Wildlife Service

Objectives:

1. To determine seasonal movements of pronghorn;
2. to determine breeding strategies used by pronghorn in two habitat types (low sagebrush-bunchgrass and playa);
3. to determine pronghorn fetus survival rates; and
4. to determine general condition of an overwintering herd.

Results:

Nine additional location flights were made during the reporting period. Three mature females suffered winter mortality (2 from Sheldon, 1 from Hart Mountain). One additional mortality is suspected, but as yet, not confirmed. This mortality could not be linked to the trapping operation.

Locations were made on the radio-collared kids from a related study until battery failure occurred during February. These locations will be included with the information obtained on the adults.

The winter was considered mild with little snowfall. The wintering density of pronghorn did not reach the intensity that had been observed the previous year, therefore the full extent of pronghorn seasonal movements may not have been observed. Additional data will be collected next winter.

Data concerning breeding strategies will be collected during the next reporting period.

Habitat Selection and Use, Movements, and Home Range of Malaysian Seladang (*Bos gaurus hubbacki*) on a Disturbed Range in Central Pahang, Malaysia

Project Leader:	B.W. O'Gara
Student Investigator:	P. Conry
Cooperators:	Department of Wildlife and National Parks Malaysia, Smithsonian-Peace Corps Environmental Program, U.S. Peace Corps Malaysia

Objectives:

1. To develop chemical capture techniques and establish guidelines for drug dosages.
2. To describe seladang habitat use and selection, movements, and home range in the Lepar River study area.
3. To describe seladang food habits.
4. To investigate seladang interactions with man, including:
    a. impacts of agricultural development and associated disturbance,
    b. impacts of logging activities and associated disturbance, and
    c. response to habitat management projects.
5. To suggest guidelines for management of seladang in disturbed habitats.

Results:

The student investigator completed field work initiated in 1976. Five seladang were radio-collared but subsequently, 2 of the 5 transmitters failed. Movements of 3 seladang were monitored and habitat use recorded.

The student investigator is analyzing data and taking courses. The thesis should be completed by December 1980.

A Comparison of Feeding and Nesting Habitat Use by Woodpeckers in First and Second Year Burns

Project Leaders:	B.R. McClelland, J.H. Lowe
Student Investigator:	M. Harris
Cooperators:	McIntire-Stennis, University of Montana School of Forestry, Champion International

Objectives:

1. To compare woodpecker population densities within and adjacent to the burns.
2. To identify bark- and wood-inhabiting insect species and their distributions within the study areas.
3. To characterize woodpecker foraging habits within the burns.
4. To characterize woodpecker nest sites within and near the burns.
5. To propose management guidelines for post-fire logging which would maintain suitable habitat for woodpeckers and associated cavity nesters.

Results:

The first of two field seasons was completed on 1 August 1979 in the Pattee Canyon study area. Three species of woodpeckers, the Hairy (Dendrocopos villosus), Northern Three-toed (Picoides tridactylus), and Black-backed Three-toed (P. arcticus), were observed in this 2-year-old burn.

Transects were run within the burn in both logged and unlogged areas giving woodpecker densities of 0.25 and 0.33 individuals per acre, respectively. An additional transect was run in the adjacent unburned forest which indicated a woodpecker density of 0.09 individuals per acre.

Several parameters of woodpecker foraging habits were measured. No significant difference in foraging height was found between the three woodpecker species. However, when differences between the sexes within a species were analysed, a difference (sig. level 0.05) was found in the Northern Three-toed woodpecker.

The dbh (diameter at breast height) of the trees in which the woodpeckers were observed foraging was also measured. A significant difference in foraging-tree dbh was found between all three species of woodpecker. When differences between the sexes of each species were analysed, a significant difference in the Hairy woodpecker was observed. In addition, selection of foraging-tree species was not found to be independent of woodpecker species.

Eleven woodpecker nests were located in the Pattee Canyon burn. The range in nest-tree dbh was 13 to 37 cm with an average of 22.6 cm.

Work is currently underway on the second season of the study. Additional sites are being utilized to determine differences in use as related to the age of the burn. In addition to the woodpecker density, foraging, and nesting data previously discussed, an expanded rearing study of insects is being conducted this year. Data on bark- and wood-boring beetles species, tree species selection by the beetle and height in the trees of the beetles will be obtained.

Morphological Variation Among Bobcat Populations in the northwestern United States

Project Leader:	I.J. Ball
Student Investigator:	S. Albert
Cooperators:	NRA (tentative)

Objectives:

1. Clarify morphological affinities of bobcats from the northwestern United States with respect to cranial characters:
   a. identify geographical differences in distinct subspecific populations of bobcats based on craniometric characters.
   b. examine sexually dimorphic properties of bobcats among and within several distinct populations.
2. Describe taxonomic affinities and phylogenetic relationship of bobcat populations.
3. Identify craniometric criteria for the differentiation of bobcats and lynx (*Lynx canadensis*) groups from the northwestern U.S.

Results:

The student investigator has completed a literature review and written a research proposal. He will begin measuring and analysing cranial characteristics in July 1980. The thesis should be completed by June 1981.

Local and Long-Range Movements of Bald Eagles Associated with Autumn Concentrations in Glacier National Park

Project Leader:	B. R. McClelland
Research Associates:	D. S. Shea, H. L. Allen, E. B. Spettigue
Student Investigator:	L. S. Young
Cooperators:	U.S. Fish and Wildlife Service, National Park Service; Wildlife Management Institute; University of Montana; Border Grizzly Project

Objectives:

1. To determine migration routes, wintering areas, and nesting areas of bald eagles associated with autumn concentrations in Glacier National Park.
2. To determine daily movement patterns of bald eagles in and near Glacier National Park.
3. To characterize bald eagle morphology.
4. To monitor bald eagle numbers during autumn concentrations.
5. To prepare a comprehensive report to be used in the development of a coordinated regional management plan for bald eagles.

Results:

The student investigator took courses during the reporting period. He will begin his second field season in autumn.

Grizzly/Black Bear Interactions and Competition

Project Leader:	C. Jonkel
Student Investigator:	H. Carriles
Cooperators:	U.S. Fish and Wildlife Service; National Park Service; Montana Department of Fish, Wildlife, and Parks; U.S. Forest Service; University of Montana

Objectives:

1. Determine similarities and/or differences, if any, of grizzly/black bear food habits from radio-location data and scat analysis.
2. Compare grizzly/black bear food habits to the phenology, productivity, and nutrient content of important bear plant food species within selected habitat components.
3. Determine and compare habitat component preferences of both species in areas of home range overlap.
4. Determine and compare feeding strategies of both species in areas of home range overlap. Investigate possible temporal and/or spacial separation or exclusion by one species or the other on preferred feeding sites.

Results:

The student investigator worked on a Canada goose nesting study in the Flathead Valley during April and May. He began field work on the grizzly/black bear project in May, in the North Fork of the Flathead River study area. Low elevation phenology plots were put in on the riverbottoms and lower avalanche chutes. Higher elevation plots remain to be located. Plant food samples have been collected for nutrient analysis.

An adult black bear was captured, radio-collared, and released at the end of May. Approximately 5-7 additional black bears are expected to be captured and collared this field season. Grizzly and black bears will be intensively radio-tracked throughout the season; locations will be visited promptly and phenology plots sampled at least bi-weekly.

Mission Mountains Grizzly Bear Study

Project Leader: C. Jonkel
Student Investigator: C. Servheen
Cooperators: Bureau of Indian Affairs; Confederated Salish and Kootenai Tribe; U.S. Fish and Wildlife Service; Montana Department of Fish, Wildlife, and Parks; School of Forestry, University of Montana

Objectives:

1. Determine the seasonal habitat preference of grizzly bears in the Mission Mountain area.
2. Determine denning sites and denning activity of grizzlies in the Missions.
3. Determine population status, density, and distribution of grizzly bears in the Mission area.
4. Determine seasonal food habits of grizzlies in the Missions and relate food habits to habitat preferences.
5. Develop a management plan for the Flathead Indian Reservation based on sound biological data from research findings.

Results:

The denning research findings were presented as a paper at the Fifth International Conference on Bear Research and Management at Madison, Wisconsin in February 1980. The paper will appear in the published proceedings of the meeting. Data were compiled throughout the spring. Graphic representation of findings were also completed. The student investigator continued to write in an effort to complete his dissertation by July 1980.

Nesting and Feeding Habits of Trumpeter Swans

Project Leader: R. L. Hutto
Student Investigator: Paul Hampton
Cooperators: U.S. Fish and Wildlife Service, Harriman State Park, Targhee National Forest

Objectives:

1. To quantify plant and animal materials eaten by Trumpeter Swans on the Henry's Fork during winter.
2. To quantify the structural (vegetative or physical) features that are necessary to provide nesting and feeding areas during winter.
3. To quantify plant and animal material located inside exclosures that would be utilized if the barriers were absent.

4. To establish time budgets for the swans on the breeding range in the Targhee National Forest to determine the amount of time spent on the nest.
5. To establish nest temperature records to determine the extent of egg cooling.

Results:

In late December 1979, the student investigator began to observe swan behavior from five locations within Harriman State Park to determine how the swans spent their time, what types of food were being consumed and how much food was consumed. Throughout the winter, several interesting facts were noted. First, there was an increase over time in the amount of feeding and locomotor activities while the time spent in alert and threat postures remained constant. Second, the swans appeared to be very inefficient in obtaining food because of the fast, channelized current of the river. This often resulted in other species of waterfowl congregating around feeding swans and capitalizing on the leftover food. Third, observations showed that the major food items ingested were Potamogeton pectinatus and P. richardsonii accompanied by the occasional catching and eating of brook trout (Salvelinus fontinalis).

During the winter the student was able to recover six dead trumpeter swans. Three of these were so decomposed that only the skeleton remained. Two were intact and were sent to the National Health Laboratory in Madison, Wisconsin, to be necropsied. The cause of death for one was determined to be the ingestion of a fish hook and the other died of exposure. Unlike the first five, the digestive tract of the sixth bird was intact and filled with food. Approximately 1 kg of plant material (mostly Myriophyllum exalbescens) and 0.5 grams of animal material (mostly bivalves) were found.

On 9 May, the first eggs were laid on Swan Lake, followed one day later by Chain Lake. On 23 May, eggs were laid on Silver Lake. The nest monitoring equipment was put on each of these nests when two eggs had been laid. The equipment is composed of infra-red photoelectric cells to indicate when a swan arrives at or leaves the nest; remote thermisters mounted in artificial eggs to monitor nest temperature; and remote cameras to take pictures of each nest at preset intervals. The swans have completely accepted the equipment except for the artificial egg, which they broke. They did however accept the thermister if it was placed approximately 1 cm below the eggs in the nest materials.

Throughout the rest of the summer, the student will continue to monitor nest activities as well as cygnet production and survival. In mid-June and October he will resample the aquatic vegetation and invertebrates to determine if there are any major changes in the swans' winter habitat.

Habitat Selection, Populations, and Control of Black-Tailed Prairie Dogs (*Cynomys ludovicianus*) on the Charles M. Russell National Wildlife Range

Project Leader:	B. W. O'Gara
Student Investigator:	C. Knowles
Cooperator:	U.S. Fish and Wildlife Service, Charles M. Russell National Wildlife Range

Objectives:

1. Determine distribution, size and status of all prairie dog towns within the Wildlife Range;
2. determine habitat selection by prairie dogs within the Wildlife Range;
3. determine population dynamics of prairie dogs and identify environmental factors which may influence numbers of prairie dogs within and between years within a prairie dog town;
4. investigate the dynamics of colonization by prairie dogs of the Wildlife Range;
5. evaluate and compare the effectiveness of three possible methods of control--poisoning, shooting and habitat alteration; and
6. investigate the association and relationship of prairie dogs to areas of intensive livestock use and/or areas of human disturbance.

Results:

The student investigator took classes winter and spring quarters and will resume field work this summer.

Morphological Variations Within the Subspecies *Ursus arctos horribilis*

Project Leaders:	B. W. O'Gara and C. Jonkel
Student Investigator:	H. W. Sherwood
Cooperators:	Montana Department of Fish, Wildlife and Parks, Bozeman Laboratory; J. J. Craighead

Objectives:

1. To develop new procedures for accurately measuring variations in cranial characteristics with regard to age and sexual dimorphism; and
2. to further clarify understanding of the systematics of the brown/grizzly bear complex in North America.

Results:

The student investigator has completed measuring and examining cranial characteristics. He is now analyzing the data and writing his thesis. A summary should appear in the next biannual.

Winter Ecology of Mule Deer in the Rattlesnake Gulch Area

Project Leader:	I.J. Ball
Student Investigator:	R. Yeager
Cooperators:	Confederated Salish and Kootenai Tribes; Bureau of Indian Affairs; National Rifle Association

Objectives:

1. Document the relative importance of various habitat types to the mule deer that winter in the Rattlesnake Gulch Area.
2. Describe movement patterns of the deer and distribution on the winter range.
3. Estimate population size and age/sex composition.

Results:

Radio collars were placed on 3 does and 1 female yearling during mid-March. Relocation data will be collected on both the summer and winter ranges. Environmental parameters such as basal area, canopy cover, shrub cover, and snow depth were recorded at 238 winter bed sites. Backtracking of deer was conducted when snow conditions permitted. Distance traveled and snow depth were recorded within each cover type during tracking. Daily temperatures and relative humidity were monitored from a weather station at Hot Springs, Montana. The study will continue through March 1981.

The Effects of 1080 Control of Columbian Ground Squirrels on Target and Non-target Mammal and Bird Populations

Project Leader:	B. W. O'Gara
Student Investigator:	J. C. Malloy
Cooperators:	Montana Departments of Agriculture, Livestock, and Fish, Wildlife and Parks.

Objectives:

1. To estimate changes in non-target bird and mammal populations subsequent to treatment on control and experimental areas;
2. to estimate changes in Columbian groung squirrel population levels subsequent to treatment on control and experimental areas; and
3. to estimate the toxicity of 1080 poisoned ground squirrel carcasses recovered in the field to selected mammalian and avian scavengers.

Results:

The student investigator spent winter and spring quarters taking classes and began his second season of field work in the spring.

Determining the Value of Riparian Habitats to Nongame Birds and Assessing the Effects of Livestock Grazing on Avian Community Structure

Project Leader:	L. Hutto
Student Investigator:	S. Mosconi
Assistant:	J. Marslof
Cooperators:	U.S. Fish and Wildlife Service, Denver Wildlife Research Center

Objectives:

1. Define the value of riparian habitats to nongame birds.
2. Determine the effects of livestock grazing on the structure of avian communities in riparian habitats.

Results:

The student took courses during the reporting period. She is now in the field for the second season.

Ecology and Management of the River Otter in Southwestern Montana

Project Leader:	B.W. O'Gara
Student Investigator:	H. Zackheim
Cooperators:	Montana Department of Fish, Wildlife, and Parks; National Wildlife Federation

Objectives:

1. To develop a technique to survey river otter populations.
2. To determine relative densities of otters on area rivers.
3. To identify characteristics of otter habitat.
4. To assess the impacts of harvest on otter populations.

Results:

Initial efforts have focused on locating otter sign and inventorying the range of riparian habitat types on the region's major rivers. An intensive winter track survey on the Big Hole River has helped delineate populations on about 60 km of that river. Additional information has been collected through surveys and interviews with area trappers.

Preliminary work has begun on developing a scent-station survey technique for otters and these efforts will continue through the summer and fall. If successful, all major area rivers will be surveyed to gain an index of otter populations with which future surveys can be compared to indicate population trends.

Elk Habitat Selection and Use, Movements, and Home Range on a Disturbed Summer Range in Western Montana

Project Leader: C. L. Marcum
Student Investigator: J. Lehmkuhl
Cooperators: Bureau of Land Management, Montana Forest and Conservation Experiment Station

Objectives:

1. Describe environment available to elk.
2. Describe elk habitat selection and use, movements and home range on a forested summer range subject to concurrent logging.
3. Compare data with information obtained in the "pre-disturbance" phase of the long-term study.

Results:

The student is working for the USFS and completing his thesis. The summary should appear in the next biannual.

The Food Habits of and Habitat Selection by a Barren Ground Grizzly Female and Cubs, Brooks Range, Alaska

Project Leader: B. W. O'Gara
Student Investigator: J. Hechtel
Cooperators: Alaska Department of Fish and Game, Naval Arctic Research Laboratory, National Wildlife Federation, Wildlife Management Institute, National Audubon Society, Theodore Roosevelt Memorial Fund of the American Museum, Arctic Institute of North America

Objectives:

1. To examine in detail the seasonal food habits of a female grizzly and her two offspring, and to provide a general account of bear food habits on the western North Slope.
2. To determine daily movement and activity patterns, seasonal movements and the home range of the bears.
3. To describe and map portions of habitat within the home range of the family group.
4. To determine the seasonal habitat use patterns of the bears.
5. To conduct qualitative analysis of important bear food items.

Results:

The student investigator is working in Alaska. He will return to the University in August and complete his thesis.

Pathology of Sarcocystis hemionilatrantis

Project Leader: B.W. O'Gara
Student Investigator: D.B. Pond
Cooperator: National Bison Range

Objectives:

1. To conduct a survey and establish Sarcocystis infection rates in the ungulates of the National Bison Range.
2. To determine the life cycle of Sarcocystis sp. found in mule deer, white-tailed deer, and coyotes.
3. To determine pathology in the respective hosts.

Results:

The student investigator has completed the survey of the ungulate populations on the National Bison Range. The results were published earlier this year. The life cycle of Sarcocystis hemionilatrantis in mule deer and coyotes has been completed. The pathology in the mule deer is still being examined.

Ecology of the Bobcat (Lynx rufus) in a Coniferous Forest Environment

Project Leader: J. Ball and C. J. Jonkel
Student Investigator: S. Albert
Cooperator: Montana Department of Fish, Wildlife and Parks

Objectives:

1. Describe overall status of western Montana bobcat populations and evaluate their structure and dynamics;
2. characterize habitat requirements, home range, and general movements;
3. delineate reproductive processes and relate them to the state of the overall population;
4. evaluate food preferences by stomach analyses and scats; and
5. suggest management options based on the results of this study which could improve management of bobcats.

Results:

The core study area is being changed due to extremely low bobcat populations in the Rock Creek Drainage. Student Investigator Albert has shifted to another project.

One bobcat was trapped and radiomarked in the Garnet Range. Intensive capture efforts will continue in this area in November 1980. A student is being recruited for the project.

Ecological Relationships of the Bobcat in Northwestern Nevada

Project Leader:	B.W. O'Gara
Student Investigator:	R. Flynn
Cooperators:	National Wildlife Federation, U.S. Fish and Wildlife Service, Nevada Department of Wildlife

Objectives:

1. To determine bobcat movement patterns on the Sheldon National Wildlife Refuge, Nevada.
2. To describe bobcat habitat selection.
3. To determine the relative abundance of bobcat prey species within the major habitat types.

Results:

Recently completed field work has determined that this study is not feasible because of limited funding and problems encountered in the field work. Thus, this study will be terminated at this time and the student investigator will begin working on another project. A brief summary of the most important results from this study follows.

A total of 7 bobcats were captured and radio-collared during the initial trapping period (Novebmer and December) including 1 yearling male, 1 yearling female, 2 adult females, and 3 juvenile females. The captures resulted from 1196 trap-days over 46 days for a capture rate of 150 trap-days per capture. Poor signal reception from the ground because of the rough terrain of the study area hindered the radio-tracking program. Thus, very few relocations of the radio-collared animals were obtained and several of the animals were lost after a short time period. By May, none of the radio-collared animals could be located.

The yearling male (#1) was never relocated and assumed to have immediately left the study area. The yearling female (#3) was relocated 6 times before being killed by a trapper 6.5 km southwest of the capture site 33 days later. A lone adult female was relocated 4 times over 8 days with the last location 8 km south of the capture site. The other adult female with the 3 juvenile females composed a family group which remained together until late November when the adult female began to spend more time away from the kittens, and the kittens began to travel independent of each other. By January, one kitten (#5) had dispersed 5 km from the adult female's home range and the other kittens could not be located. The adult female (#6) was relocated 12 times over 5 months in a minimum home range area of 8 km^2. Field work during May did not produce any new captures (400 trap-days) or any locations of previously collared animals.

Seasonal Habitat Selection Movements and Home Range Size of Bobcats (*Lynx rufus*) in Northcentral Montana

Project Leader:	B. W. O'Gara
Student Investigator:	P. R. Knowles
Cooperators:	Charles M. Russell National Wildlife Refuge

Objectives:

1. To determine home range size and spatial arragements of bobcats on the study area;
2. to determine seasonal habitat selection and movements of bobcats on the study area; and
3. to provide recommendations for management guidelines to the Charles M. Russell National Wildlife Refuge and the Montana Department of Fish, Wildlife and Parks.

Results:

Field work was continued until mid-February. Both male radio-collared kittens were illegally taken by hunters in January. The discarded collars were found but the carcasses were not recovered. An additional kitten, a 4.8 kg female, was captured and radio-collared in late January. She disappeared in mid-February.

The student investigator returned to Missoula because of lack of snow tracking conditions and resumed class work spring quarter. The final field season will commence in June.

Ecology of Sage Grouse on the INEL Site

Project Leader:	I.J. Ball
Student Investigator:	J. Connelly
Cooperators:	U.S. Department of Energy, Idaho National Engineering Lab

Objectives:

1. Quantify the number of sage grouse on the 900 mi^2 INEL Site throughout the year.
2. Determine the primary or "key use" area of both resident and migrant sage grouse on the INEL Site.
3. Determine migration routes and summer locations of sage grouse wintering on the INEL Site.
4. Determine radionuclide concentrations in grouse on the INEL Site and determine, in particular, the movements of grouse utilizing areas known to contain "above background" concentrations of radionuclides.
5. Describe the sage grouse wintering areas (in particular the vegetation) on and near the INEL Site.

Results:

Student investigator Connelly has essentially completed th

field work and is involved primarily in data analysis. Approximately 650 grouse have been captured and marked, and 65 leks have been located on the Site. Vegetation measurements are complete and analyses have begun. Completion of the thesis and related publications is expected by September 1981.

Population Fluctuations and Distribution Patterns of Mallards in the Pacific Northwest

Project Leader:	I.J. Ball
Student Investigators:	Michael J. Rabenberg and Lois Regen
Cooperators:	U.S. Fish and Wildlife Service, Refuge Division, Portland; Battelle Pacific Northwest Laboratories.

Objectives:

1. Document factors influencing the number of mallards wintering in the Columbia Basin.
2. Document timing, duration, and distance of mallard feeding flights.
3. Investigate interchange of birds between major resting areas.
4. Determine food and field-type preferences of wintering mallards.
5. Document any changes in average physical condition of mallards over the winter.
6. Study the dynamics of flock composition, flock sizes, sex ratios, and pair status over time and between areas.
7. Analyze band recovery data from mallards banded in the Pacific Northwest.

Results:

The second full season of field research was conducted from 15 November, 1979, to 10 February, 1980. Twenty-five, 15, and 5 mallards were radio-marked on Columbia NWR, the Department of Energy Hanford Site, and Umatilla NWR, respectively, from late November through early January. Back-mount radio packages weighing 15 to 17 grams were used this field season rather than nasal saddle mounts. Contact with radioed birds was vastly improved over last year, presumably due to the better designed radio package.

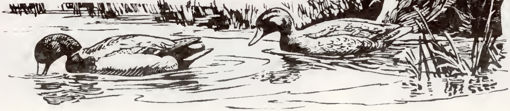
Approximately 290 kilometers of land-use transects through several major mallard upland feeding areas were run in mid-October, late November, and early January. This data will allow determination of the relative abundance of various land-use classes over time, and quantitative description of which fields mallards are selecting over time and with varying weather conditions. Over 100 field-feeding locations were recorded throughout the winter. In addition, Washington Department of Game employees have provided an additional 60 locations. Approximately 250 esophagii were removed from hunter-killed mallards during the 1979-80 hunting season. Their contents will be analyzed to obtain further information on seasonal

variations in food habits and the possibility of differential grain selection between drakes and hens.

Systematic observations of sex ratios, flock composition, and pair status over time and between areas were continued. Intensive studies on feeding-flight chronology were also conducted. Data on mallard production indices and land-use trends over time are being collected to dtermine their influences on the population of wintering Columbia Basin mallards.

Lois Regen completed her thesis on the banding analysis. The abstract follows:

> The major objectives of a study of mallard (Anas platyrhynchos) banding data were (1) to determine the geographic and chronological distributions of recoveries from mallards banded after the hunting season in the Pacific Northwest from 1950 to 1976, and (2) to estimate survival and recovery rates of mallards wintering in the Columbia Basin area of Washington. Recoveries from post-season bandings in Washington, Oregon, and Idaho (n=11,470) and from preseason bandings in the Columbia Basin (n=2,456) were mapped and tabulated. From 1950 to 1976, mallards banded in the post-season banding period in the Columbia Basin showed an increasing tendency to be recovered in the Columbia Basin. This trend probably reflected larger mallard harvests resulting from the liberalization of hunting regulations in the Columbia Basin Special Seasons. Survival rate estimates of mallards banded in the Columbia Basin during the post-season banding period were relatively stable from 1950 to 1976, and were not correlated with fluctuations in the size of the wintering population. Mean annual survival rates were 63% for males and 58% for females. Annual recovery rate estimates were year-dependent and were significantly higher for males (mean: 6.2%) than for females (mean: 3.7%).



CONSERVATION, EDUCATION, AND PUBLIC RELATIONS

B.W. O'Gara

18 January	Met personnel of the Bitterroot National Forest, advised on bighorn sheep capture sites, and darted a bighorn ewe to demonstrate radio marking.
28 January	Met with National Wildlife Federation officials regarding elk management on NWF winter range in the Missoula area.
30 & 31 January	Attended Wildlife Society Meetings in Bozeman and presented a paper on hunting and antihunting sentiment.
4 February	Gave a slide presentation on African game ranching to Wildlife Management class for nonmajors at U of MT.
7 February	Gave a slide presentation "Let's Tell the Truth about Predation" to student chapter of TWS at U of MT.
7 & 14 February	Lectured 3 hours on pronghorn biology and management to big game Conservation Course at U of MT.
12 February	Testified in a Missoula County Court hearing on the Wooten Estate regarding importance of the Wooten property to wintering big game.
20 February	Reviewed a 34 page manuscript for the U.S. Fish and Wildlife Service editor.
22 February	Conferred with Montana executive secretary of the Wildlife Federation on student applications for support.
27 February	Reviewed a 20 page manuscript for the Journal of Mammalogy.
27 February	Lectured to Wildlife Management class on predation problems and management.
28 February	Lectured for 2 hours to Wildlife Techniques class on identifying predator kills.
29 February	Lectured to Wildlife Management class on game ranching.
5 March	Gave a slide lecture on Asian and African Parks to the Parks Management Class, School of Forestry, Missoula.
11 April	Reviewed a 26 page manuscript for the BBA Proceedings.
25 April	Spent the entire day in the field and at meetings with local ranchers and representatives from EPA, the Montana Departments of Livestock and Agriculture, and the Defenders of Wildlife regarding 1080 poisoning of ground squirrels in western Montana.
January-March	Taught Wildlife Parasites and Diseases and co-taught, with Ball, Biological writing. Both were graduate level courses.

15 May	Lectured to Superior, MT, Outdoor School on wildlife management.
16 May	Met with A. Christensen and C. Jonkel regarding grizzly bear research on the Kootenai National Forest.
21 May	Attended a meeting on deer/elk management on Grantland.
2 June	Met with personnel from the Lolo National Forest to plan a mountain goat transplant into the Rattlesnake Drainage.
9 June	Spent the day with the Wildlife Federation Land Management Committee laying out bridal trails that would have minimal impact on big game migrations.
10 June	Reviewed 17 research proposals for McInntire-Stennis Program, Forestry School, U of MT.
23 June	Necropsied a bison calf for the National Bison Range.
25, 27 & 30 June	Spent 12 hours lecturing to a summer class for gifted children at Lolo, Montana, on wildlife techniques and management, predation problems and management, hunting ethics, and planning a research project.

I.J. Ball

18 January	Met with MT F.W.P. personnel in Kalispell to discuss goose research.
25 February	Lectured to Wildlife Management class at U of MT. on compensatory mortality.
6 March	Met with the management planning team for Wild Horse Island State Park and discussed Unit studies on the Island.
January-March	Taught Waterfowl Ecology/Management, and co-taught, with O'Gara, Biological Writing. Both were graduate level courses.
1 May	Met with National Bison Range Manager R. Brown, W. Kessler, C. Jonkel, and R. Bown regarding reintroduction of Columbian Sharptail Grouse on NBR.
8 May	Lectured to U of MT. Bird Management Class on waterfowl management.
12-23 May	Attended Continuing Education Program for Wildlife Biologists at Moscow, Idaho, and presented a 3-hour

	session on population biology and management.
19 June	Attended meeting of the Flathead Valley Canada goose management committee, National Bison Range.
20 June	Reviewed a 5 page manuscript for the Murrelet.
24 June	Reviewed an 11 page manuscript for the Journal of Wildlife Management.

A. L. Sheldon

January	Organized and chaired symposium "Population and Community Ecology of Running Water Insects." American Society of Limnology and Oceanography. Presented paper "Beyond Metamorphosis: the ecological significance of adult stream insects." Los Angeles.

S. Albert

	Judged the Montana State Science Fair.
	Lectured to the Mammalogy Class, University of Montana on Cats of North America.
8-10 April	Attended Northwest Section Meeting, The Wildlife Society.

W. Bodie

7-8 April	Attended the 9th Bienneal Antelope states workshop in Nogales, Arizona, and presented a paper on the weak-fawn syndrome.

G. Burnett

	Showed Glacier National Park study area and discussed Pine marten management with Bob Klaver, Wildlife Biologist for BIA, Flathead Indian Reservation.

T. Butts

24 January	Lectured to Large Mammal Conservation class at University of Montana on bighorn sheep biology and management.

25 January	Gave same lecture to the Community College Wildlife class in Ronan, Montana.

H. Carriles

11 January	Attended Grizzly Bear Workshop on populations in the Border Grizzly Area, Missoula, Montana
26-27 February	Attended Grizzly Bear Recovery Plan Workshop on habitat, Missoula, Montana.
18 March	Attended Grizzly Bear Workshop (Selway-Bitterroot), Missoula, Montana.

M. Harris

23 February	Accompanied Audubon group on a "Woodpecker walk" through one study area.
8-10 April	Attended Northwest Section Wildlife Society meeting in Banff, Alberta, Canada.

P. Knowles

8-10 April	Attended Northwest Section Wildlife Society meeting in Banff, Alberta, Canada.

L. Kopec

8-10 April	Attended Northwest Section Wildlife Society meeting in Banff, Alberta, Canada
	Attended Northern Wild Sheep and Goat Council Symposium.

J. Lehmkuhl

30 January-1 February	Attended Montana Chapter Wildlife Society Annual Meeting, Bozeman, Montana.
15 February	Lectured on Wildlife Telemetry at Salish Kootenai Community College, Ronan, Montana.

A. Lester

29 March	Gave a slide lecture on "Numerical Responce of Woodpeckers and their Effect on Mortality of Mountain Pine Beetles in Lodgepole Pine in Northwestern Montana" at the Northwest Scientific Association Meeting in Moscow, Idaho.
8 May	Gave the same presentation at Sigma Xi Scientific Research Society of North America Meeting in Missoula, Montana.

J. Malloy

25 April	Gave a presentation to a group of Environmental Protection Agency administrators, representatives of the Montana Departments of Agriculture and Livestock, and Blackfoot Valley landowners on the subject of nontarget mortality observed during the 1979-1980 baiting campaign.
12 June	Gave a presentation to representatives of 19 Montana counties on research planned to document the hazards of 1080 poisoning of Columbian ground squirrels to nontarget species.

M. McNay

Participated in orientation for hunters at Hart Mountain National Wildlife Refuge, Oregon.

J. Meeker

8 February	Gave talk at Redding, California, meeting of the Western Section TWS on Pronghorn-feral horse interactions.
4 March	Gave a seminar on feral horse/pronghorn interactions at University of Nevada, Reno, Nevada.
7-8 April	Attended the 9th Biennial Antelope States Workshop in Nogales, Arizona, and presented a paper on trapping pronghorns.
10 April	Met with manager of the Cabeza Prieta and an airforce representative to plan a study on the endangered Sonoran pronghorn.

J. Parker

29 March	Gave a slide lecture on "Great Blue Herons: Nesting habitat use and the effects of human disturbance." at the Northwest Scientific Association Meeting in Moscow, Idaho.
8-10 April	Attended the Annual Meeting of the Northwest Section Wildlife Society in Banff, Alberta, Canada.
8 May	Gave same presentation at Sigma Xi Scientific Research Society of North America Meeting in Missoula, Montana.

C. Servheen

11 January	Presented population summary to the Grizzly Recovery Team.
15-20 January	Coordinated 1980 Midwinter Bald Eagle Survey for Montana.
11-13 February	Presented paper to the Bear Biology Association.
26 February	Presented population analysis results to the Grizzly Recovery Team.
27 February	Presented talk on Grizzly biology to the Bureau of Indian Affairs Banquet.
28 February	Presented talk on Grizzly habitat and the ESA to the Wildlife class, University of Montana.
2-4 April	Did UBC computer modeling of grizzly populations for Grizzly Recovery Team.
7 May	Met with Lolo forest personnel concerning Rattlesnake area and the Grizzly.
27-28 May	Met with Northern Tier Pipeline consultants concerning possible effects of pipeline on the Grizzly and the Bald Eagle.
14-15 June	Presented paper at the Symposium on Research and Management of the Bald Eagle in Washington state.

H. Sherwood

26-27 January	Attended Grizzly Bear Workshop in the Border Grizzly Area, Missoula, Montana.
10-13 February	Attended the 5th International Conference on Bear Research and Management, Madison, Wisconsin.

L. Young

9-10 January	Attended the Northern States Bald Eagle Recovery Team Meeting in Denver, Colorado.
14 February	Attended Nongame Bird Habitat Management Workshop - Session 5 in Salt Lake City, Utah.
22-24 February	Attended a workshop - Bald Eagles in the Klamath Basin: A National Concern, in Klamath Falls, Oregon.
14-15 June	Attended the Washington Bald Eagle Symposium in Seattle, Washington.

P. Zager

10-13 February	Presented a paper "Timber Harvest, Wildfire, and Grizzly Bears in Northwestern Montana" at the 5th International Conference on Bear Research and Management, Madison, Wisconsin.
8-10 April	Attended the Northwest Section of the Wildlife Society Meetings in Banff, Alberta, Canada.

PUBLICATIONS

Frost, P.G.H., I.J. Ball, W.R. Siegfried, and F. McKinney. 1979. Sex ratios, morphology and growth of the African Black Duck. Ostrich 50:220-233.

Jenni, D.A. 1979. Female Chauvinist Birds. New Scientist 82(1159): 896-899.

Sheldon, A.L. 1979. Stonefly (Plecoptera) records from the basin ranges of Nevada and Utah. Great Basin Naturalist 39:289-292.

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BIANNUAL REPORT

of the

MONTANA COOPERATIVE WILDLIFE RESEARCH UNIT

University of Montana

Missoula, Montana

to

UNIVERSITY OF MONTANA

MONTANA FISH, WILDLIFE, AND PARKS COMMISSION

WILDLIFE MANAGEMENT INSTITUTE

U.S. FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR

Vol. 30, No. 1
July-December 1979

Respectfully submitted,

Bart W. O'Gara, Leader

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MONTANA COOPERATIVE WILDLIFE RESEARCH UNIT PERSONNEL

Coordinating Committee

Robert F. Wambach, Montana Fish, Wildlife, and Parks Department, Helena
W. Leslie Pengelly, University of Montana, Missoula
Bart W. O'Gara, U.S. Fish and Wildlife Service, Missoula

Unit Staff

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Joe Ball, Assistant Leader
John J. Craighead, Affiliate in Zoology and Forestry
John T. Harris, Forestry School
Donald A. Jenni, Zoology Department
Charles Jonkel, Forestry School and Montana Fish, Wildlife and Parks Department
Lee H. Metzgar, Zoology Department
W. Leslie Pengelly, Forestry School
Robert R. Ream, Forestry School
Andrew L. Sheldon, Zoology Department
Philip L. Wright, Zoology Department
"Ginger" Schwarz, Unit Secretary

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Gary Burnett
Patricia McBride
Robert Yaeger
Mike McDonald
Tom Butts
Kerry Murphy
Mark McNay
John Lehmkuhl
Len Kopec
Amy Lester
Dennis Daneke
Jill Parker
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Sandra Martin
Ellen Adelman
Patrice Corneli
Pete Zager
Pam Knowles
Matt Wunder
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Rod Flynn
Mary Harris
Sandra Mosconi
Leonard Young
Jo Meeker
John Malloy
Jack Hogg
Paul Hampton
Mike Rabenberg
Jack Connelly
Harry Carriles
Barbara Slott

COOPERATING AGENCIES

University of Montana
Montana Fish, Wildlife, and Parks Department
Wildlife Management Institute
U.S. Fish and Wildlife Service

Alaska Fish and Game Department
Alberta Fish and Wildlife Branch
Arctic Petroleum Operators Association
Audubon Society
Bitterroot National Forest
Border Grizzly Project
British Columbia Wildlife Branch
Bureau of Indian Affairs
Bureau of Land Management
Canadian National Sportsmen's Shows
Canadian Wildlife Service
Churchill Northern Studies Centre
Denver Wildlife Research Center
Environmental Research Institute
Flathead National Forest
Friends of the Rattlesnake
Idaho Cooperative Wildlife Research Unit
Idaho Department of Fish and Game
Interagency Grizzly Bear Team
Maine Department of Inland Fisheries and Wildlife
Manitoba Department of Mines, Resources, and Transportation Services
McInntire Stennis
Montana Forest and Conservation Experiment Station
Montana Power Company
National Bison Range
National Geographic Society
National Rifle Association
Nature Conservency
Naval Arctic Research Laboratory, University of Alaska
Nevada Department of Fish and Game
New York Zoological Society
Norsk Polarinstitutt
Northwest Territories Fish and Wildlife Service
Parks Canada
Quebec Wildlife Service

Salish Kootenai Tribal Council
U.S. Forest Service
U.S. National Park Service
U.S. National Science Foundation
University of Alaska
University of Copenhagen
University of Guelph
University of Maine
University of Montana Foundation
University of Oslo
Washington Fish and Game Department
Wildlife Federation
World Wildlife Fund (Canada)
Wyoming Game and Fish Department
Yellowstone National Park

PERSONNEL NOTES

Dr. Joe Ball was appointed Assistant Unit Leader in July 1979. A native of Peoria, Illinois, Joe received his undergraduate training in Wildlife Biology at Utah State University and his M.S. and Ph.D. at the University of Minnesota. His thesis research involved movements, habitat use, and survival of duck broods in north-central Minnesota. After graduation, Joe spent a year in South Africa working on behavior and ecology of the African Black Duck. He went directly from the African assignment to Washington State University where he taught Wildlife courses and conducted research for five years. Joe has conducted or supervised a number of research projects on waterfowl and sagegrouse in the Northwest and at Delta, Manitoba.

RESEARCH PROJECTS

Physiologic and Ecologic Studies of the Pronghorn (*Antilocapra americana*)

Project Leader: B. W. O'Gara
Cooperators: National Bison Range, U.S. Fish and Wildlife Service; Yellowstone National Park, U.S. National Park Service; and the Montana Fish, Wildlife and Parks Department

Objectives:

To study:

1. the reproductive physiology of male and female pronghorn;
2. the physiology and function of scent glands;
3. food habits related to changes in range conditions;
4. horn growth and casting; and
5. the relationship of pronghorns to other artiodactyls.

Results:

Work was continued on the pronghorn book.

The Effects of Hunting on a Mountain Lion (*Felis concolor*) Population in Western Montana

Project Leaders: B. W. O'Gara and K. G. Greer
Student Investigator: Kerry M. Murphy
Cooperators: U.S. Forest Service; Montana Department of Fish, Wildlife and Parks

Objectives:

1. To examine age structure, density, natality, and the distribution of mountain lions in hunted and unhunted drainages of the study area.
2. To investigate hunting pressure and harvest of mountain lions in the study area, and relate those data to population characteristics.
3. To determine timing and distance of dispersal by young animals and the age of sexual maturity in males.
4. To identify and describe winter habitat requirements of

mountain lions in the study area, specifically those relating to the aquisition of prey.

Results:

The student investigator is spending three winters in the field marking lions with cooperating houndsmen. Four mountain lions have been instrumented with radio collars and/or marked to date. The student is taking habitat measurements at kill and resting sites. Reproductive tracts, stomachs, and feces are being collected from lions harvested around western Montana. The study and the thesis should be completed by spring 1982.

A Survey of the Nongame Mammals in the Upper Rattlesnake Drainage of Western Montana

Project Leader:	B. W. O'Gara
Student Investigator:	E. B. Adelman
Cooperators:	U.S. Forest Service; Montana Fish, Wildlife and Parks Department; Montana Power Company; Friends of the Rattlesnake; McInntire Stennis

Objectives:

1. To determine what species of nongame mammals inhabit the Drainage, their distribution by habitat, and relative abundance within each habitat.
2. To determine in a general way, the nature of the prey base and how it is utilized within each habitat type.
3. To make suggestions regarding the impact(s) various management options could have on the nongame mammals in the Drainage.

Results:

The student investigator completed her thesis. The summary follows.

Between June 1977 and March 1979, a survey was conducted of the nongame mammals in the Upper Rattlesnake Creek Drainage of western Montana. Trapping, scent stations, and observations of sign or the animals indicated what species inhabited the Drainage and their distribution by habitat. Mammal diversity within each habitat and niche breadth and overlap were determined from the trapping and scent station results.

Snaptrap lines were used in 14 locations, representing 18

habitat types as follows: ponderosa pine/Idaho fescue, Douglas-fir/ninebark-ninebark (at 2 elevations), Douglas-fir/blue huckleberry-beargrass, Douglas-fir/twinflower-snowberry, Douglas-fir/snowberry-pinegrass, Douglas-fir/snowberry-snowberry, grand fir/unknown, grand fir/queencup-queencup (2 elevations), subalpine fir/queencup-menziesia, subalpine fir/bluejoint-bluejoint, subalpine fir/menziesia, subalpine fir/beargrass-blue huckleberry, subalpine fir/beargrass-grouse whortleberry, clearcut, disturbed meadow, and cottonwood bottom.

Small mammal diversity varied greatly from 1 habitat to another, related directly with the species richness and evenness of the habitats, and indirectly with community dominance. Elevation was the habitat feature with the strongest relationship to diversity; shrub development and tree canopy closure were not significantly correlated with diversity. The time of year trapping occurred and camping activities in 2 sites probably influenced measures of diversity also.

Deer mice and jumping mice had the broadest niches with the former occurring in most of the habitat types and the latter in a variety of mesic types. Red-tailed chipmunks, vagrant shrews, yellow pine chipmunks, and red-backed voles had progressively smaller niches, reflecting each species' habitat preferences. Apparently having the narrowest niches were the masked shrew, northern bog lemming, long-tailed vole, meadow vole, and northern flying squirrel, each of which occurred in a single habitat type.

Most species pairs did not overlap much, if at all, in habitat use, especially when resource abundance was considered. Shrews and red-backed voles overlapped although their utilization of each habitat was in proportion to its abundance. Masked and vagrant shrews, shrews and red-tailed chipmunks, deer mice and yellow pine chipmunks, and meadow voles and bog lemmings largely used the same habitats. However, only for the latter pair was the probability of interspecific encounter considerably higher than it would be if the 2 species were uniformly distributed with respect to habitat.

A scent station line, passing through a variety of vegetational types, was used twice during summer 1977. Mammal species diversity also varied greatly but showed no relationship to habitat. The road, used as a travel corridor by some species and avoided by others, undoubtedly influenced diversity. The average diversity, however, was somewhat higher in September than in July-August, probably because less food was available for some species and populations were largest in September.

Chipmunks, deer mice, and golden-mantled ground squirrels, occurring in a variety of habitats, had the widest niches. Red squirrels, columbian ground squirrels, unidentified cricetids,

coyotes, porcupines, and bushy-tailed woodrats had smaller niches; leporids, skunks, jumping mice, weasels, red foxes, marten, black bears, badgers, and bobcats had the narrowest niches. Niche width also varied between the 2 months as some species had smaller niches in September (the hibernators mostly), whereas others had larger niches (decreased food availability so animals wandered more in search of food).

Niche overlap was moderate for most pairs, a few did not overlap at all (particularly in September), and some showed a relatively large amount of overlap (deer mice and chipmunks, chipmunks and golden-mantled ground squirrels, and porcupines and bushy-tailed woodrats). Predators generally did not use the same habitats very much although use tended to be concentrated in a few areas.

Observation of sign (tracks, scats, middens, diggings, or cuttings) and of the mammals were used primarily to indicate the presence of a species in the Drainage. Habitats were determined for a few mammals, however. Red squirrels occurred under forest canopies and snowshoe hares under brushy cover throughout the area; pocket gophers and columbian ground squirrels in lower elevation, open areas; muskrats and beavers along the creeks; pikas in rock piles and talus slopes above 1450 m; grizzly bears in subalpine areas around McLeod Peak; marten in mature subalpine fir and spruce forests; and black bears, coyotes, and cougars used a number of habitats throughout the Drainage. Other mammals present were hoary and yellow-bellied marmots, short-and long-tailed weasels, mink, striped skunks, wolverines, lynx, and wolves.

Prey species were abundant throughout the study area and were used by a number of mammalian and non-mammalian predators.

The impact of any management operation varies, not only with the size and intensity of the operation, but also from 1 species to another. To some extent, logging and fire tend to have similar effects: plant succession is reversed; a mosaic of vegetational types is created (and in the case of periodic fire, maintained); mammalian diversity increases, as do populations of deer mice, chipmunks, and other small rodents; and habitat is destroyed for species dependent on climax or mature forests (i.e., marten and wolverine). Recreation probably can have the most adverse impact, destroying habitat, creating problem animals (those accustomed to food handouts), and disturbing wildlife (chasing them or being in the wrong place at the wrong time). Wilderness can be particularly beneficial to mammals intolerant of human influences (i.e., grizzlies, marten and wolverine) because areas are preserved in essentially

a natural condition. However, two previously mentioned factors are also involved with wilderness management, fire and recreation, both of which have an impact on the quality of the wilderness.

Pronghorn Fawn Mortality on the National Bison Range Following Selective Control of Coyotes During Spring

Project Leader:	B. W. O'Gara
Student Investigator:	P. Corneli
Cooperators:	Denver Wildlife Research Center, National Rifle Association, National Bison Range

Objectives:

1. To examine the causes and degree of pronghorn fawn mortality on the National Bison Range following selective control of coyotes;
2. to determine the density of coyotes;
3. to determine the relative densities of alternative coyote prey; and
4. to compare findings with data from previous studies without coyote control.

Results:

The student investigator completed her thesis. The summary follows.

1. How coyote control affected pronghorn fawn mortality on the National Bison Range was studied in 1978.

2. During May, 19 coyotes were shot, snared, or poisoned. At least 1 resident breeding pair survived control.

3. Of an estimated 92 fawns born, 34 were radio-tagged between 20 May and 7 June; 22 tagged fawns died before 1 August. Ten predator-caused mortalities included 3 bobcat kills, 4 Golden Eagle kills, and 3 unidentified predator kills. One fawn may have succumbed to capture myopathy caused by an eagle, and coyotes probably consumed 3 fawns. The remains of 6 fawns consisted of only bone and hide fragments. Three transmitters failed and 1 fell off prematurely. Cause of death for those 10 fawns was not determined, but 7 were apparently healthy 24-48 hours before they died, so predator involvement was the most plausible explanation for their rapid disappearance.

4. Seventy percent of an estimated 92 fawns died before

1 August; by mid-October, the mortality rate was virtually unchanged (71%). Of the tagged sample mortality, 87.5% occurred within the first 3 weeks of life.

5. Although the fawn mortality rate remained high, despite control, it was not uniformly high on all fawning grounds. The rate was 93% of the southeast range, where the bobcat and eagle kills occurred. It was only 27% in Alexander Basin, where coyote-related mortality was very high in 1975 (90%) and in 1977 (93%); other mortality factors did not compensate for the absence of coyote predation there.

6. Numerous possible compensating mortality factors, including disease, precipitation, abandonment by dams, and poor habitat, were eliminated as important mortality factors. Predation, apparently a noncompensatory mortality factor among NBR fawns, was still the most important cause of death in 1978.

7. Bobcat predation compensated for the absence of coyote predation in the southeast, as bobcats moved into former coyote hunting grounds. The proximity of preferred fawning grounds to bobcat habitat on the southeast range and the bobcats' increased predator experience probably increased the fawns' vulnerability to bobcat predation.

8. A transitory sub-adult Golden Eagle may have caused increased eagle predation in 1978. The ridges and draws on the southeast range were more conducive to eagle predation than the flatter terrain on Alexander Basin. Eagles are an intermittent though sometimes significant cause of mortality on the NBR.

9. Certain conditions on the NBR may have increased the herd's vulnerability to decimation by coyotes. Fences enclosed pronghorns with experienced predators, and may have interfered with escape. Sustained throughout the year by alternate prey, coyotes do not depend on pronghorn for survival and could ruinously control the small, isolated herd.

10. During 7 years of high fawn mortality, recruitment into the breeding population was low. As a result, in 1978, 65% of the breeding age adults were probably over 7 years old. A serious population decline could occur in 2-3 years.

11. When successive years of high predator-caused mortality threaten the breeding population, spring coyote control could improve fawn survival enough to prevent a serious population decline. Coyote populations are resilient, so periodic control would not threaten NBR coyotes with extirpation.

White-tailed Deer Movements, Survival, and Population Characteristics in the Clearwater River Drainage, Montana

Project Leader:	B. W. O'Gara
Student Investigator:	B. Slott
Cooperator:	Montana Fish, Wildlife and Parks Department

Objectives:

To further determine and describe:

1. summer distribution of white-tailed deer which winter in the Salmon Lake Area of the Clearwater Drainage;
2. production and survival, and conversely, mortality factors affecting this deer population;
3. population status--numbers and trend;
4. food habits; and
5. range conditions.

Results:

The student investigator completed her thesis. The summary follows.

From December 1978 through September 1979, an ecological study of white-tailed deer was conducted in the Clearwater River Drainage of western Montana. The objectives were to analyze population characteristics, winter food habits, winter range condition, and summer distribution of the white-tailed deer herd that winters near Salmon Lake.

Analyses of population characteristics included estimation of total numbers, sex and age ratios, mortality, breeding season, physiological condition, and physical measurements. Whitetail numbers were estimated at 400 to 550 on the 7.4 square mile (19 km^2) study area or 54 to 75 deer/square mile (21 to 29 deer/km^2). Adult: fawn ratios for 1978 and 1979 were 100:48 and 100:51, respectively, indicating good fawn survival. The adult and yearling male:female ratio for December 1979 was 23:100.

The major mortality factor was hunter harvest. Between 10% and 20% of the population was harvested each year. Winter mortality was moderate in 1978 and fairly high in 1979. Predation was not a significant factor in deer mortality during winter.

All adult and yearling does examined were pregnant, as was one fawn. One 5.5-year-old doe was carrying three fetuses. The conception dates of 14 fetuses ranged from 19 November to 6 December.

Most adult deer survived the winters in good condition, but one adult and two fawns showed signs of malnutrition.

Analyses of food habits indicated that coniferous and deciduous browse was most frequently used. Species receiving the greatest use were Douglas-fir, chokecherry, serviceberry, and Rocky Mountain maple.

Most of the white-tailed deer wintering near Salmon Lake migrated north or northwest during the summer. Deer were found in all six major habitat types present on the summer range (Douglas-fir/dwarf huckleberry, Douglas-fir/pinegrass, Douglas-fir/blue huckleberry, Douglas-fir/snowberry, Subalpine fir/menziesia, and Subalpine fir/beargrass). The only common factor in summer home range selections seemed to be the presence of a water supply, with associated succulent vegetation.

The deer population exceeded the present carrying capacity of the winter range. This problem can be solved in two ways: manipulation of deer numbers and/or manipulation of the habitat. The feasibility of both of these options should be examined.

Development of Immunity and Pathology of Sarcocystis hemionilatrantis

Project Leader:	C. A. Speer
Student Investigator:	D. B. Pond
Cooperator:	Microbiology Dept., U. of MT., National Bison Range, National Science Foundation

Objectives:

1. To conduct a survey and establish Sarcocystis infection rates in the ungulates of the National Bison Range.
2. To determine the life cycle of Sarcocystis sp. found in mule deer, white-tailed deer, elk, bison and coyotes,
3. and to determine what immunity and pathology develops in the respective hosts.

Results:

The student investigator has completed the survey of the ungulate populations on the National Bison Range. The results were published earlier this year. The life cycle of Sarcocystis hemionilatrantis in mule deer and coyotes has been completed. The pathology in the mule deer is still being examined. The results on the development of the parasite in the coyote are complete (Pond and Speer in press). The abstract follows.

Sarcocystis hemionilatrantis sp. n. (Eimeriorina: Sarcocystidae) is described as a heteroxenous coccidian with the coyote (Canis latrans) as the final host and mule deer (Odecoileus hemionus) as

the intermediate host. Oocysts measured 21 x 17.5 um, and were shed sporulated and/or unsporulated in the feces of coyotes, which had previously ingested Sarcocystis - infected meat. Sporocysts, which were also shed in the feces, measured 16 x 10 um and had 4 sporozoites and a granular residuum. The prepatent period was 9 to 13 days and the patent period occurred between 9 to 13 days and 43 days after coyotes ingested infected mule deer musculature. At 3 and 5 days after infection, spheroid stages arising from bradyzoites were found; some of these appeared to fuse to form zygotes. Zygotes and oocysts in various stages of sporulation occurred in the lamina propria of the villi in the distal 1/3 of the duodenum, jejunum and ileum except for 6 inches immediately anterior to the ileocecal valve. No microgamonts or meronts were found. Coyotes were susceptible to reinfection with the same meat to establish the original infection. Little or no histological response occurred in a 12 day primary infection; however, a severe cellular response occurred in a 14 day primary infection as well as in reinfection.

The project leader has received a grant from the National Science Foundation for a 3 year study. Work on the remaining aspects of the study will begin this spring.

Numerical Response of Woodpeckers and Their Effect on the Mortality of Mountain Pine Beetles in Lodgepole Pine in Northwestern Montana

Project Leaders:	B. R. McClelland, H. Lowe
Student Investigator:	A. Lester
Cooperators:	McInntire Stennis, University of Montana School of Forestry; National Park Service, Glacier National Park

Objectives:

1. To determine densities of woodpeckers and mountain pine beetles (Dendroctonus ponderosae) in areas of endemic and epidemic beetle populations.
2. To assess woodpecker-caused mortality of mountain pine beetles.
3. To characterize active woodpecker nest trees and relate the findings to forest management practices.

Results:

Field work was conducted in Glacier National Park from March 1978 through September 1979. Data analysis is incomplete at this time. Preliminary results are discussed below.

Five species of woodpeckers were observed feeding on beetles and nesting on the epidemic study plots: Downy (Picoides pubescens), Hairy (P. villosus), Northern Three-toed (P. tridactylus), Black-backed Three-toed (P. arcticus), and Pileated (Dryocopus pileatus) Woodpeckers. The highest winter density was 57.3 woodpeckers per 100 acres. The highest breeding season density was 14.3 pairs of woodpeckers per 100 acres. No woodpeckers or woodpecker nests were found on the endemic study plot.

Hairy and Downy Woodpeckers generally selected aspen or birch with visible evidence of heart rot decay (conks) for nesting. Of 13 Northern Three-toed and Black-backed Three-toed Woodpecker nests, only 2 were in aspen. Nine were in beetle-killed lodgepole, and 2 were in old lodgepole snags. Northern Three-toed Woodpeckers were the most abundant woodpecker species and accounted for the high winter and breeding season woodpecker densities on the study plots. Apparently, this woodpecker is best adapted to exploit the abundant food source and utilize lodgepole pine, a species generally not preferred, for nesting.

Conclusions regarding beetle densities and woodpecker-caused mortality of beetles cannot be drawn until analysis of all data is complete.

The Food Habits of and Habitat Selection by a Barren Ground Grizzly Female and Cubs, Brooks Range, Alaska

Project Leader:	B. W. O'Gara
Student Investigator:	J. Hechtel
Cooperators:	Alaska Department of Fish and Game, Naval Arctic Research Laboratory, National Wildlife Federation, Wildlife Management Institute, National Audubon Society, Theodore Roosevelt Memorial Fund of the American Museum, Arctic Institute of North America

Objectives:

1. To examine in detail the seasonal food habits of a female grizzly and her two offspring, and to provide a general account of bear food habits on the western North Slope.
2. To determine daily movement and activity patterns, seasonal movements and the home range of the bears.
3. To describe and map portions of habitat within the home range of the family group.
4. To determine the seasonal habitat use patterns of the bears.
5. To conduct qualitative analysis of important bear food items.

Results:

The student investigator spent 15 May through 29 July in the field. He groundtracked the same family group of grizzly bears as in previous years and collected information on these and other bears regarding movements, activity patterns, behavior, food habits, habitat use and predation on caribou. Over 230 hours of behavioral observations were recorded including one continuous 7 day period. This period began while female No. 1086 and her young traveled together as a family group, included the initial encounter with a breeding male and the dispersal of the young, and ended with 3 days of observations of breeding behaviour. The female directed most of her aggressive actions at her male offspring (No. 1164). She often permitted her 3-year-old female offspring (No. 1087) to travel and feed close to her but would, without apparent provocation rush 1164 when he was feeding 20 m. away. Yet, after 1087 initiated a nursing bout, 1164 approached submissively and was allowed to suckle.

The student investigator is preparing a detailed description of the weaning-breeding behavior of the bears. He worked for Alaska Fish and Game through December and is now employed by the University of Alaska analyzing data.

A Survey of Ungulates in the Rattlesnake Creek Drainage

Project Leader: B. W. O'Gara
Student Investigator: P. McBride
Cooperators: U.S. Forest Service; Montana Fish, Wildlife and Parks Department; Montana Power Company Friends of the Rattlesnake

Objectives:

To determine the relative numbers, habitat relationships, and seasonal distributions of ungulates in the Rattlesnake Creek Drainage.

Results:

The student investigator has finished her thesis, but it was lost in the mail. The summary should appear in the next Biannual Report.

ter Habitat Selection and Movement of Elk (*Cervus elaphus*) in the nage of the Middle Fork of the Flathead River, Montana

Project Leader: B. W. O'Gara

Student Investigator: M. McDonald
Cooperators: Montana Fish, Wildlife and Parks Department, Flathead National Forest

Objectives:

1. To describe and determine winter habitat type and use.
2. To determine seasonal migratory routes via monitoring of radioed and collared elk.

Results:

The student investigator is working for a consulting firm and writing his thesis. The summary should appear in the next Biannual Report.

A Study of Bighorn Sheep on Upper Rock Creek, Granite County, Montana

Project Leader: B. W. O'Gara
Student Investigator: T. Butts
Cooperators: Bureau of Land Management; Montana Fish, Wildlife and Parks Department

Objectives:

1. To determine herd size and composition and ewe/lamb ratios; and
2. to identify specific ewe/lamb habitat areas and movement paths and patterns.

Results:

The student investigator is working for BLM and analyzing data. The thesis should be completed during winter 1980.

A Study of the Causes for Poor Pronghorn Fawn Survival on the Charles Sheldon Antelope Refuge, Nevada

Project Leader: B. W. O'Gara
Student Investigator: M. McNay
Cooperators: U.S. Fish and Wildlife Service, Nevada Department of Fish and Game

Objectives:

1. To examine the causes and degree of pronghorn fawn mortality.
2. To evaluate the impact of livestock use on fawning areas.

3. To evaluate the adequacy of fawn bedding sites in relation to mortality.

Results:

Radio collars were attached to 34 fawns, 20 males and 14 females, during the 1978 and 1979 fawning seasons. Mortality of monitored fawns was 79% in 1978 and 57% in 1979. During both years, 90% of the fawn mortality occurred in the first 3 weeks of life. During that period the estimated mean age at death for monitored fawns was 7.5 days in 1978 and 11.1 days in 1979.

Predation was the main source of mortality, accounting for 82% of the mortality in 1978 and 67% in 1979. Coyotes (Canis latrans) were involved in 16 of the 17 (94%) deaths attributed to predation and 1 kill was attributed to a Golden Eagle (Aquila chrysaetos). Abandonment-starvation, accidental, and death from undetermined causes accounted for the remainder of the mortality.

Thirty-four hours of observation were logged in a study of cattle-pronghorn interactions. For the Mule Mountain area a correlation coefficient (r) was calculated and a tendency for pronghorn-cattle segregation was shown ($r= -.83, p\ .01$).

An attempt was made to determine what effect cattle use of pronghorn fawning areas might have on fawn survival. Vegetative structure and composition around fawn bed sites was measured. Spatial interactions between pronghorns and cattle were observed and fecal samples from both species were collected to determine dietary overlap.

In addition, information from hunter check stations, analysis of coyote scats, pregnant doe census data, and territorial buck behavioral information will be evaluated.

The student investigator is working on his thesis and it should be available in June 1980.

Elk Habitat Selection and Use, Movements, and Home Range on a Disturbed Summer Range in Western Montana

Project Leader: C. L. Marcum
Student Investigator: J. Lehmkuhl
Cooperators: Bureau of Land Management, Montana Forest and Conservation Experiment Station

Objectives:

1. Describe environment available to elk.
2. Describe elk habitat selection and use, movements and home range on a forested summer range subject to concurrent logging.
3. Compare data with information obtained in the "predisturbance" phase of the long-term study.

Results:

Data collected during the 1978 field season were analysed, and the results were reported to the granting agencies in the annual progress report. Results indicated that the area chosen to study elk-logging relationships is an important part of the range of elk using the study area. Although the core study area (CSA) comprises only 13% of the total area used by the elk, 29% of the radioed elk locations occurred there. Summer use was highest with 38% of the summer locations in the CSA. A correlation between annual precipitation and use of the CSA became evident after examining trends in pellet counts and the telemetry results in relation to trends in annual precipitation over the last 3 years. In dryer years, the CSA received relatively more use than in wetter years. This probably resulted from the fact that the CSA contains the higher elevations found within the range of the Chamberlain Creek elk. This relationship will allow us to more easily identify causal relationships for changes in elk movements and habitat selection that may occur when logging begins in the CSA.

With regard to habitat selection, intermediate elevations (5100'-5600' within a range of 3900'-6800'), concave horizontal slope configurations, and mature-old tree stands of mixed species composition were used greater than availability. Other.habitat factors were either used about equal to or less than availability.

Elk did not appear to avoid open roads during the calving and summer seasons, nor did they seem to avoid the same roads during the fall when they were closed. Logging related disturbance was limited during 1978 to the construction of a main haul road and to some logging outside the CSA. Elk use was significantly lower than availability for areas within 0.5 miles of active human disturbance.

Data for the 1979 field season are currently being analysed. Elk movements and habitat selection were again monitored by aerial tracking of radio-collared elk, and by pellet-group counts. Elk movements and activity were also monitored for 24-hour periods to

discern movement patterns on a finer time scale. A limited amount of road building and logging occurred in the study area during 1979. Logging was scheduled to begin in the CSA this year, but, due to delays in road building, logging was postponed until 1980. Consequently, the thesis will contain a limited amount of information concerning the effects of logging on elk. The thesis should be available by spring 1980.

A Study of an Introduced Mountain Sheep Herd in the Petty Creek Drainage, Montana

Project Leader:	J. Harris
Student Investigator:	L. Kopec
Cooperators:	Montana Fish, Wildlife and Parks Department, Lolo National Forest

Objectives:

The primary objectives of this study are to:

1. locate and map seasonal ranges and movements;
2. census the herd; and
3. assess productivity.

Results:

The Petty Creek herd consists of approximately 30 to 35 sheep with a sex ratio of approximately 70 rams:100 ewes. Nine lambs were born during the 1979 lambing period, and all survived the summer. Nearly all of the adult ewes produced young.

The herd apparently separated into several small groups which spent the driest part of the summer at the higher elevations and near permanent free water. Few locations were made during the summer, and capture operations were unsuccessful.

Winter trapping operations will be concentrated on the French Gulch winter range to obtain sheep for radio-collaring and marking.

Food Habits, Health, Population Dynamics, and Hunter Impact on the Middle Fork Elk Herd, Flathead Drainage, Montana

Project Leader:	B. W. O'Gara
Student Investigator:	D. Daneke
Cooperators:	Montana Fish, Wildlife and Parks Department, the Flathead National Forest, and the National Rifle Association

Objectives:

1. To determine the seasonal food habits and report the abundance and importance of each item;
2. to determine the quality of key winter browse species;
3. to determine the herd's age structure;
4. to determine the calf production levels; and
5. to determine the effect of hunting on population characteristics.

Results:

Eighteen monthly herd classification counts were completed. These data are being analyzed to determine calf production, group characteristics, and bull/cow ratios. Feces were sent to the Range Sciences Laboratory at Colorado State University for analysis. Results are expected by 1 April 1980.

As reported in the first biannual report for 1979, data collection and analysis are complete for the in-vitro digestion trials of key winter browse species, mineral lick ion content, winter kill examinations, and winter browse surveys.

The thesis should be completed by 1 June 1980.

Habitat Selection, Populations, and Control of Black-Tailed Prairie Dogs (*Cynomys ludovicianus*) on the Charles M. Russell National Wildlife Range

Project Leader:	B. W. O'Gara
Student Investigator:	C. Knowles
Cooperator:	U.S. Fish and Wildlife Service, Charles M. Russell National Wildlife Range

Objectives:

1. Determine distribution, size and status of all prairie dog towns within the Wildlife Range;
2. determine habitat selection by prairie dogs within the Wildlife Range;
3. determine population dynamics of prairie dogs and identify environmental factors which may influence numbers of prairie dogs within and between years within a prairie dog town;
4. investigate the dynamics of colonization by prairie dogs of the Wildlife Range;
5. evaluate and compare the effectiveness of three possible methods of control--poisoning, shooting and habitat alteration; and

6. investigate the association and relationship of prairie dogs to areas of intensive livestock use and/or areas of human disturbance.

Results:

Field work was conducted from the start of the report period 11 December. A total of 108 prairie dog towns comprising 2393 ha. was located and mapped on or immediately adjacent to the Refuge. Only 89 of these towns showed current prairie dog activity. These towns occupied 303 ha. Very few towns were not associated with a disturbance factor.

The effects of the 1978 zinc phosphide poison treatment patterns in 7 prairie dog towns were re-evaluated one year post-treatment. Three of the 4 treatment patterns (center reduction, perimeter reduction and splitting reduction) appeared to have 1979 post-treatment activity levels similar to 1978 pre-treatment levels despite a 90% reduction in treated areas in 1978. Immigration into the treated areas from adjacent non-treated areas appeared to be responsible for most of this increase in prairie dogs from post-treatment 1978 to 1979. Some litters of pups were sited this summer, however, in the treated areas. Total reduction in 2 prairie dog towns resulted in activity levels only slightly higher than post-treatment 1978.

The effects of shooting on a small (1.3 ha) and a moderate (5.8 ha.) size prairie dog town was again evaluated this year. Intensive shooting was needed to produce a noticeable change in activity levels on the larger town.

Habitat alteration with predator hiding obstacles and raptor perches produced a significant reduction in prairie dog activity levels in the treated section of the town as compared to the control section from June to August but not from August to October. Prairie dog activity levels in both sections of the town dropped significantly from June to August and from August to October.

Fencing to exclude livestock from a portion of one town did not produce any reduction in prairie dog numbers as determined from live trapping. The population trend in the treated section was consistent with the control section of the town.

Prairie dogs were live trapped and marked in the same 3 towns as the previous year. In 2 towns numbers were only slightly higher than last summer. In the other town, however, there were about 2 times as many prairie dogs as were present in 1978. This was a result of good reproductive effort and immigration from a larger nearby prairie dog town.

Forty-five observations of dispersing prairie dogs and/or places dispersing prairie dogs had dug burrows were made from 14 May to 18 July. A total of 52 such observations have now been made since the start of the study. Two types of dispersal movements have been identified: 1. within town (usually short distance) 2. out of town (usually long distance). Eight of the 16 individuals collected were males and 8 were females. Thirty-one of the 32 individuals actually observed to be traveling were on a road when first observed. Three prairie dogs were found drowned along the shore of Fort Peck Reservoir. The furthest distance of a dispersing individual from a known prairie dog town was 6.4 km. All observations of dispersing prairie dogs were of single individuals.

Inventory and Analysis of the Range and Wildlife Resources, Wildhorse Island, Flathead Lake, Montana

Investigator:	L. Eddelman
Student Investigator:	D. Kautz
Cooperators:	Montana Fish, Wildlife and Parks Department, Nature Conservancy

Objectives:

To provide baseline data on the Island range and wildlife resources in order to evaluate, classify, and manage such resources relative to present and future goals and objectives. The inventory shall be aimed at total Island ecology rather than emphasizing specific factors pertaining to particular wildlife species.

Results:

Two hundred and sixty-two taxa vascular plants were identified on the Island. Identification of collected mosses, lichens and mushrooms is continuing. Seven major grassland community types, exclusive of extensive areas of sparsely vegetated cliffs and talus have been described. Additional data analysis will result in a similar differentiation of forest community types. Analysis of the data on the phenologic development of the major grassland species is in progress.

With the assistance of county SCS soil scientists, 11 major soil types were identified on the Island and combined into 17 mapping units. These units where designed to incorporate the major topographic variables observed. Correlation with the on-going county wide soil survey will provide a broad, authoritative base for management interpretations.

The diversity of wildlife on the Island has been documented with a species list that includes 102 bird and 12 mammal species. Additional wildlife observations include pattern of use by the major grazing mammals (Bighorn sheep, Mule deer and the feral horse and mule) and nesting habits of six diurnal birds of prey.

Finally, cultural features observed on the Island, including private docks and cabins, dilapidated structures and old fences have been compiled on the base map.

Additional analysis of the remaining data is on-going with completion of the final thesis tentatively scheduled for the early summer of 1980.

University of Montana Grizzly Bear Research Investigations

Investigator:	J. J. Craighead
Co-Investigator:	J. S. Sumner and J. Varney
Student Assistants:	J. Mitchell and G. Scaggs
Cooperators:	U.S. Forest Service; Montana Fish, Wildlife and Parks Department; Idaho, Wyoming and Alaska Departments of Fish and Game; National Rifle Association; National Geographic Society; Environmental Research Institute; University of Montana Foundation; Idaho Cooperative Wildlife Research Unit

Objectives:

1. To complete for publication with F. C. Craighead, Jr., a 15-year study of grizzly bears in the Yellowstone ecosystem and to encourage management agencies to utilize the research findings.
2. To develop a rapid, accurate, low-cost method of typing, mapping, and evaluating grizzly bear habitat utilizing LANDSAT imagery and computer-assisted analysis.
3. To continue studies of grizzly bears in the Lincoln-Scapegoat Wilderness Area in order to:
   a. determine relative bear numbers and relate this information to habitat use;
   b. quantify the amount, quality, distribution and seasonal fluctuations of three major plant foods used by grizzly bears.
4. To continue investigations of historic and present occupancy of the Selway-Bitterroot Wilderness by grizzlies and by using satellite-computer-assisted technology to determine the quality of the present habitat for possible re-introduction.

Results:

Not reported this Biannium.

River Preservation

Project Leaders: J. J. Craighead and F. C. Craighead, Jr.
Assistant: B. W. O'Gara
Cooperators: University of Montana Foundation, Environmental Research Institute, U.S. Forest Service, and the National Geographic Society

Objectives:

1. To produce an educational lecture film on river preservation.
2. To assist federal, state, and private organizations to evaluate and classify rivers for inclusion in the National Wild and Scenic River System.
3. To promote the National Wild and Scenic River concept through publications and illustrated lectures.
4. To encourage student involvement in environmental issues related to river preservation and management.

Results:

Not reported.

Seasonal Habitat Selection Movements and Home Range Size of Bobcats (*Lynx rufus*) in Northcentral Montana

Project Leader: B. W. O'Gara
Student Investigator: P. R. Knowles
Cooperators: Charles M. Russell National Wildlife Refuge

Objectives:

1. To determine home range size and spatial arragements of bobcats on the study area;
2. to determine seasonal habitat selection and movements of bobcats on the study area; and
3. to provide recommendations for management guidelines to the Charles M. Russell National Wildlife Refuge and the Montana Department of Fish, Wildlife and Parks.

Results:

Full time field work was conducted throughout the report

period. Small mammals were live trapped in representative habitat types during August. Vegetative transects, considering horizontal visibility, were conducted July through September. In late September, both of the kittens associated with the radio-collared adult female were observed together with the female. One of these kittens, a 4.8 kg male, was radio collared on 17 October. The adult female was in the immediate area when the kitten was trapped but subsequently, however, has not been associated with the kitten. The other kitten has not been trapped nor has it been seen since the September siting. Trapping effort was intensified after the end of the hunting season in late November. On 2 December, another 4.8 kg male was captured in an area outside of the home ranges of the other radio marked bobcats and is probably not related. Relocations of the 2 adult radio marked bobcats as well as the 2 newly captured kittens has continued on a daily basis; resulting in 188 relocaions for the adult female, 77 for the adult male, 59 for the kitten of the marked female and 11 for the other kitten as of 31 December. Trapping will continue as long as conditions are favorable and field work will continue into March.

An Investigation of Elk-Cattle Relationships on Elk Winter Ranges of the Crazy Mountains, Montana

Project Leader:	J. T. Harris
Student Investigator:	M. Wunder
Cooperator:	U.S. Forest Service

Objectives:

1. To estimate the combined elk and cattle carrying capacity of the elk winter range;
2. to determine how increasing elk numbers will affect cattle grazing on National Forest Lands;
3. develop an option oriented plan to suggest relative elk and cattle numbers, including possible management actions to achieve and maintain desired population levels; and
4. suggest locations for permanent indicator transects, plots and or exclosures to monitor winter range vegetation changes.

Results:

In June 1978, 17 areas were selected for intensive sampling to determine pellet group distributions, vegetative condition, trend, soil condition, and forage utilization by cattle. In addition, questionnairs were sent to all ranchers owning land adjacent to or within the National Forest Boundary. During the summer of 1979, the distribution of pellet groups was rechecked on the same areas and cattle distributions in the mountains were noted. The data have

been compiled and a preliminary analysis suggests that winter elk use is consistently heavy while cattle use is light to moderate and variable. All of the areas checked showed fair to good range condition with an upward trend. Forage utilization by cattle was light on all of the areas checked. The analysis of the data will continue through the winter and the thesis should be completed by June 1980.

Morphological Variations Within the Subspecies *Ursus arctos horribilis*

Project Leaders: B. W. O'Gara and C. Jonkel
Student Investigator: H. W. Sherwood
Cooperators: Montana Department of Fish, Wildlife and Parks, Bozeman Laboratory; J. J. Craighead

Objectives:

1. To develop new procedures for accurately measuring variations in cranial characteristics with regard to age and sexual dimorphism; and
2. to further clarify understanding of the systematics of the brown/grizzly bear complex in North America.

Results:

The student investigator has completed measuring and examining cranial characteristics. He is now analyzing the data and writing his thesis.

Ecology of the Bobcat (*Lynx rufus*) in a Coniferous Forest Environment

Project Leader: J. Ball and C. J. Jonkel
Student Investigator: S. Albert
Cooperator: Montana Department of Fish, Wildlife and Parks

Objectives:

1. Describe overall status of western Montana bobcat populations and evaluate their structure and dynamics;
2. characterize habitat requirements, home range, and general movements;
3. delineate reproductive processes and relate them to the state of the overall population;
4. evaluate food preferences by stomach analyses and scats; and
5. suggest management options based on the results of this study which could improve management of bobcats.

Results:

The student investigator has begun initial field work in the Upper Rock Creek study area and will remain through the winter snow period. Data describing snow and weather conditions will be gathered from several stations set up throughout the area. Camps have been established to operate a live-trap line to capture, mark and radio-tag bobcats.

Ecological Relationships of the Bobcat in Northwestern Nevada

Project Leader:	B. W. O'Gara
Student Investigator:	R. Flynn
Cooperators:	National Wildlife Federation, U.S. Fish and Wildlife Service, Nevada Department of Fish and Game

Objectives:

1. To investigate bobcat population parameters on the Sheldon National Wildlife Refuge, Nevada, including:
    a. density of adult females, den locations, and activity patterns at den sites;
    b. kitten production, mortality, and dispersal;
    c. home range locations and size, movements, and spatial relationships.
2. To describe bobcat food habits, including:
    a. composition of prey species in the diet;
    b. age-specific food relationships;
    c. relative abundance of primary prey species.

Results:

Initial field work was conducted from October through December. During this period seven bobcats were successfully captured and radio-collared. Several relocations were obtained for most of the animals. Scats were collected and stored for future analysis. The student investigator will complete course work during the winter quarter and continue field work in April.

Determining the Value of Riparian Habitats to Nongame Birds and Assessing the Effects of Livestock Grazing on Avian Community Structure

Project Leader:	L. Hutto
Student Investigator:	S. Mosconi
Assistant:	J. Marslof
Cooperators:	U.S. Fish and Wildlife Service, Denver Wildlife Research Center

Objectives:

1. Define the value of riparian habitats to nongame birds.
2. Determine the effects of livestock grazing on the structure of avian communities in riparian habitats.

Results:

Field work began June 11, 1979. Two grazed and two ungrazed riparian sites were selected and summer censuses were conducted in each site. Measurements of several vegetation parameters were made at fixed points along the census transect. These measurements will be compared with similar measurements taken where selected species were observed either feeding or nesting. The selected species are those that show changes in abundance or loss from ungrazed to grazed sites. Approximately 30 feeding and (if possible) 10 nesting observations will be made for each species.

Transects were also established in pine, fir, and spruce-fir forests and will be censused by the assistant. This information will be compared to that obtained in the riparian censuses.

Four censuses in each site will also be taken during fall, winter, and spring for information on seasonal use. A second year of data collection will be similar to this one and will begin next summer.

A Comparative Analysis of Ecological Relationships Between Woodpeckers and Insect Prey Species in Cut and Uncut Sections of the Pattee Canyon Burn

Investigator:	B. R. McClelland
Student Investigator:	M. Harris
Cooperator:	Lolo National Forest

Objectives:

1. To compare woodpecker population densities in the Pattee Canyon burn and adjacent unburned forest;
2. to identify species and distribution of insects fed upon by woodpeckers within the burn;
3. to characterize microhabitat preferences exhibited by insect prey species within the burn;
4. to characterize woodpecker nesting sites within and adjacent to the burn; and
5. to propose management guidelines for post-fire logging which would maintain suitable habitat for woodpeckers and associated cavity nesters.

Results:

The first of 2 seasons of field work was completed during the summer of 1979. Feeding, nesting, and density data were gathered for the Hairy (Dendrocopos villosus), Northern 3-toed (Picoides tridactylus), and Black-backed 3-toed (Picoides arcticus) woodpeckers. A survey of the insect species in the burn was conducted through rearing studies utilizing timber cut throughout the area. The last field season will resume in March 1980 and will be completed in July 1980.

Local and Long-Range Movements of Bald Eagles Associated with Autumn Concentrations in Glacier National Park

Project Leader:	B. R. McClelland
Research Associates:	D. S. Shea, H. L. Allen, E. B. Spettigue
Student Investigator:	L. S. Young
Cooperators:	U.S. Fish and Wildlife Service, National Park Service; Wildlife Management Institute; University of Montana; Border Grizzly Project

Objectives:

1. To determine migration routes, wintering areas, and nesting areas of bald eagles associated with autumn concentrations in Glacier National Park.
2. To determine daily movement patterns of bald eagles in and near Glacier National Park.
3. To characterize bald eagle morphology.
4. To monitor bald eagle numbers during autumn concentrations.
5. To prepare a comprehensive report to be used in the development of a coordinated regional management plan for bald eagles.

Results:

Thirty-five bald eagles were captured during autumn 1979 using padded leghold traps; 65 eagles have been captured during the 3 project years. A series of 32 morphological measurements were made on each captured eagle. Mean wingspread of the 65 eagles was 204 cm (range 180 - 222 cm), and mean weight was 4.76 kg (range 3.4-6.4 kg). Patagial markers (yellow in 1977 and orange in 1978 and 1979, assigned by the Fish and Wildlife Service Bird Banding Laboratory) were placed on both wings, and a Fish and Wildlife Service aluminum band (No. 9) was placed on 1 leg of each eagle. Each set of patagial markers had a different code number (M01 - M10, A11 - A65) to enable identification of marked idividuals. Information sheets describing the marking were widely distributed throughout western North America.

Numerous sightings of eagles with yellow or orange markers were reported from the Glacier National Park area during the study period. Bald eagles with orange markers (assumed to have been marked in Glacier) were reported 2 km west of Creston, Montana in March 1979; near Carbondale, Colorado in April 1979; and 25 km north of the Canadian boundary, along the North Fork of the Flathead River in British Columbia in May 1979.

During autumn 1979, the student investigator conducted a telemetry feasibility study. Radio transmitters were placed on 6 eagles (2 adults and 4 subadults) between 15 October and 23 November. Transmitter packages weighed 51 g (0.8 - 1.4% of the body weight of eagles of the concentration). Transmitters incorporated variable pulse rate switching, allowing activity analysis. Transmitter packages were attached dorsally to the 2 central rectrices. A paper detailing the attachment method is in preparation. Transmitter-equipped eagles spent an aggregate 81 days in the vicinity of Glacier National Park during which time data on daily movements, activity, and habitat use were collected. Departure of transmittered eagles took place between 4 November and 5 December. The student investigator is currently engaged in long-range radio-tracking and will continue to track transmitter-equipped eagles in Montana and other western states throughout the winter, given necessary funding and interagency cooperation.

Censuses were conducted weekly between 5 September 1979 and 31 December 1979 by canoe along an 11 km water route. High count for 1979 was 516 bald eagles (305 adults and 211 subadults) which occurred on 14 November. The effects of human disturbance on bald eagle movement patterns were evaluated during weekly censuses by estimating distances to flushing eagles and eagles which remained perched as the counting canoe passed. Disturbance data were also collected from incidents of Park visitor encroachment into feeding areas.

Movements of color-marked and transmitter-equipped eagles indicate that the turnover rate of bald eagles at the Glacier concentration is high. Many eagles apparently spend only a week or two feeding in the area, then continue their southward migration and are "replaced" by other arriving eagles, all in the context of a rapidly building concentration in late October and November. The number of eagles topping in Glacier National Park may exceed 1,000, over 10% of the number of wintering bald eagles counted in January 1979 in the conterminous United States (National Wildlife Federation Mid-Winter Bald Eagle Survey).

Pronghorn Antelope Behavior in Northwestern Nevada - Southeastern Oregon

Project Leader: B. W. O'Gara
Student Investigator: J. O. Meeker
Cooperator: U.S. Fish and Wildlife Service

Objectives:

1. To determine seasonal movements of pronghorn;
2. to determine breeding strategies used by pronghorn in two habitat types (low sagebrush-bunchgrass and playa);
3. to determine pronghorn fetus survival rates; and
4. to determine general condition of an overwintering herd.

Results:

Radio collars were placed on 18 mature pronghorns between 13-17 August. Nine (5 female, 4 male) at Hart Mountain and nine (8 female, 1 male) at Sheldon were fitted with color-coded radio collars. One radio transmitter failed within 1 month after release. One trap casualty was sustained at Hart Mountain, no casualties occured at Sheldon. Five location flights were made between 10 September and 11 December and all pronghorn locations noted. These flights will be continued throughout the life of the radio transmitters.

Collection of data will continue through the next reporting period.

The Effects of 1080 Control of Columbian Ground Squirrels on Target and Non-target Mammal and Bird Populations

Project Leader: B. W. O'Gara
Student Investigator: J. C. Malloy
Cooperators: Montana Departments of Agriculture, Livestock, and Fish, Wildlife and Parks.

Objectives:

1. To estimate changes in non-target bird and mammal populations subsequent to treatment on control and experimental areas;
2. to estimate changes in Columbian groung squirrel population levels subsequent to treatment on control and experimental areas; and
3. to estimate the toxicity of 1080 poisoned ground squirrel carcasses recovered in the field to selected mammalian and avian scavengers.

Results:

Nontarget mortality associated with 1080 control of Columbian ground squirrels was investigated in the Blackfoot Valley of western Montana. Small mammal trapping and bird and carnivore population surveys were employed to detect changes on treated and untreated areas. All known instances of nontarget mortality involving animals other than mice were investigated. Toxicity testing allowed estimation of approximate lethal doses of 1080 administered as whole ground squirrel carcasses and revealed pathological signs associated with 1080 poisoning.

Estimates of small mammal population sizes, survivorship, and capture rates declined immediately after baiting on the treated area. Population estimates and capture rates increased on the untreated area.

Bird population indices varied but not in a manner attributable to the poisoning campaign. Granivorous bird populations appeared negligibly affected by 1080 baiting.

Carnivore populations were not reliably surveyed. Carcass recovery indicated that coyote mortality occurred, yet post-treatment observations indicated that coyotes and other carnivors were not extirpated, even on treated areas.

Monitoring of small mammal carcasses available above ground showed that such carcasses were available to scavengers/predators for less than 2 weeks after baiting.

Recovery of nontarget carcasses suggested that mortality may be locally high where carnivores are traditional users of a treated area.

Toxicity testing indicated that coyotes would have little difficulty in acquiring a lethal dose of squirrel carcasses, but that badgers and golden eagles would seldom be able to eat enough squirrel carcasses before such carcasses decomposed or were eaten by other species.

A Study of Social Organization, Social Behavior, and Population Dynamics in Rocky Mountain Bighorn Sheep on the National Bison Range, Moiese, Montana

Project Leader:	D. Jenni
Student Investigator:	J. Hogg
Cooperator:	National Bison Range

Objectives:

1. To compile a quantitative catalog of the frequency of occurrence and the social context of selected behavioral acts, with special emphasis on behavior during rut and lambing;
2. to quantitatively characterize social organization using the following parameters: group size, group sex ratio, group age structure, dispersion of groups and individuals with groups, relative group movement;
3. to determine the number of ewes bred, the survivorship of lambs and the causes of mortality in lambs;
4. to initiate the construction of a current or cohort life table and to identify causes of mortality in yearlings and adults.

Results:

The first field season began on June 8, 1979. Forty-two of 45 sheep are known as individuals. Approximately 400 hours of structured behavioral observation on known individuals has been completed. In addition, approximately 200 hours were spent in a census of the distribution of ewes and rams between 20 November and 1 January 1979 (rut). The study will continue part time through March 1980 and resume full time in April 1980.

The Influence of Wildfire and Logging on Grizzly Bear Habitat

Project Leader:	C. Jonkel
Student Investigator:	P. Zager
Cooperators:	U.S. Forest Service, Montana Department Fish, Wildlife, and Parks, U.S. Fish and Wildlife Service, National Park Service, University of Montana, Royal Logging Company

Objectives:

To analyze the vegetation of grizzly bear intensive-use areas in general and seral areas caused by fire and/or logging in particular. From this information, assess the relationship between vegetation (bear foods particularly) on burned areas and logged areas.

Results:

Summer work consisted of sampling additional bear use plots; all site data were mapped, analyzed, and compiled for the annual Project report. Certain types of logged units were utilized by grizzlies, others were avoided. Broadcast burning of slash on cut areas creates sites similar to burns and old-growth stands for shrubs, but forbs and graminoids follow different response patterns. Management recommendations are being drafted based on the field studies.

Mission Mountains-Swan Valley Grizzly Bear Study

Project Leader:	C. Jonkel
Field Research Leader:	C. Servheen
Field Assistants:	D. Carney, M. Madel
Cooperators:	Salish-Kootenai Tribal Council, Bureau of Indian Affairs, U.S. Forest Service, U.S. Fish and Wildlife Service, Montana Department Fish, Wildlife, and Parks, University of Montana

Objectives:

1. Determine the population level and status of the southern extent of the Border Grizzly Area bear population.

2. Determine the overall seasonal distribution and habitat use of the grizzly in the Mission Mountains, Swan Valley, and Lincoln area.

3. Determine the bear home ranges, movements, and habitat selection by use of radio-collared bears and direct field observations.

4. Determine the possibility of grizzly population recruitment into the Missions across the Swan Valley from the Swan Mountains and Bob Marshall area, and also determine if the Mission Mountains grizzly

population is self-sustaining or if the Swan Valley is an essential route for recruitment to the Missions.

5. Determine the important areas of seasonal grizzly use in the Swan Valley and map the possible grizzly travel corridors between the Swan and Mission mountains.

6. In the Mission Mountain West Slope area:

    a. Correlate land use, human activity, and habitat types with grizzly seasonal activity and use;

    b. Determine home ranges and seasonal activity of radio-collared bears in the west slope area;

    c. Assess the nature and origins of potential conflicts that arise between people and grizzlies on the west slope and develop valid management guidelines and procedures to aid tribal authorities in dealing with present and future grizzly use in the area; and

    d. Survey the attitudes of local residents in regard to their close association with grizzlies and determine, with the help of these interviews, a history of grizzly occurrence in this area.

7. Determine the population status of grizzlies in the South Fork of the Jocko-Finley-Gold-Rattlesnake creek area and attempt to determine if this population is expanding into previously unoccupied habitat.

8. Monitor the home range movements of radio-collared bears in the Jocko-Finley-Gold-Rattlesnake creek area and note range changes that occur over time; assess home range changes and habitat selection of grizzlies in this area.

Results:

Considerable radio-tracking of marked bears, bear observations, and special vegetative studies were completed. Bear activity centers, habitat components, and bear use patterns were located or determined.

Black Bear Ecology and Management in the Northern Conifer-Hardwood Forests of Maine

Project Leaders:	C. Jonkel and L. Pengelly
Student Investigator:	R. Hugie
Cooperators:	Maine Department of Inland Fisheries and Wildlife, University of Montana, University of Maine, National Rifle Association, Penobscot Valley Conservation Association, Border Grizzly Project

Objectives:

1. To determine black bear habitat and its use by bears in Maine.
    a. Describe available habitat in terms of cover types, topography, current use, and road networks.
    b. Describe bear distribution and movements in available habitat.
    c. Describe patterns of black bear behavior such as seasonal activity, sex and age similarities in movements, and how bears relate to human activity within their range.
2. To describe how black bear habitat can be perpetuated.
    a. Describe the effects of forest practices, fire, and other activities on bear habitat.
3. To describe the basic biological characteristics of black bears on the study area.

Results:

Limited field data were obtained from previously marked animals, the capture/recapture program was continued, and field data were analyzed. A chapter for the final dissertation was completed, plans for subsequent studies were finalized.

Polar Bear Studies

Project Leaders:	C. Jonkel and B. O'Gara
Faculty Cooperators:	B. Pfeiffer, H. R. Fevold
Student Investigators:	G. Miller, S. Martin, B. Cushing
Cooperators:	Manitoba Department of Mines, Resources, and Transportation Services; the Polar Continental Shelf Project; Canadian Wildlife Service; Arctic Petroleum Operators Association; Northwest Territories Fish and Wildlife Service; Churhcill Northern Studies Centre; and U.S. National Science Foundation

Objectives:

1. To develop techniques for monitoring basic physiological responses to external stimuli and relate the results to behavioral responses; to develop studies of bear deterrent-attractant-aversive conditioning.
2. To study the various biological parameters of polar bears at select Polar Basin sites:

   a. Denning areas
   b. Migrations
   c. Feeding areas
   d. Food chains, currents, climatology, etc.

3. To study the ecology of various ice features deemed important to polar bears and develop a methodology for identification and mapping of such ice types.

4. Other studies as per the detailed, NSF research outline and subproject outlines.

Results:

A draft thesis on the deterrent studies was completed (Miller). A paper for the Bear Biology Association (BBA) Conference was prepared on the deterrent results and will be presented in February 1980.

The attractant studies (Cushing) were continued as aid from the Manitoba Cooperators was increased. Certain types of people and substances were found to be powerful bear attractants. A paper on the results will be presented at the BBA Conference.

The High Arctic studies of sea ice as habitat were completed (Martin) and a thesis is in preparation. Relationships between ice topography, seals, and bears were documented. Study results will be presented at the BBA Conference.

Nesting and Feeding Habits of Trumpeter Swans

Project Leader:	R. L. Hutto
Student Investigator:	Paul Hampton
Cooperators:	U.S. Fish and Wildlife Service, Harriman State Park, Targhee National Forest

Objectives:

1. To quantify plant and animal materials eaten by Trumpeter Swans on the Henry's Fork during winter.
2. To quantify the structural (vegetative or physical) features that are necessary to provide nesting and feeding areas during winter.
3. To quantify plant and animal material located inside exclosures that would be utilized if the barriers were absent.
4. To establish time budgets for the swans on the breeding range in the Targhee National Forest to determine the amount of time spent on the nest.
5. To establish nest temperature records to determine the extent of egg cooling.

Results:

Field work began in October 1979. The plant and animal material on the Henry's Fork, both above and within the substrate, was collected using a Hess invertebrate sampler. The plants were identified to species and the weight/m^2 determined for 100 sample sites. Similarly, the invertebrate populations were samples, identified and number/m^2 determined. A preliminary analysis of these data suggests a standing crop of from 5 to 10 times the amount of biomass necessary to support the wintering swan population, yet last years necropsy reports from three swans indicated that all three had died from emaciation. The reports also indicated that all three had massive cestode infestations, which raises the question of whether a majority of the population is similarly afflicted.

Another factor brought to our attention was that wheat and aquatic vascular plants do not contain enough protein, fat or calcium to produce a hatching success rate of greater than 10 percent in pintails.[1] Apparently, an essential part of the diet is invertebrates which supply large amounts of protein, fat and calcium. However, at this time we have not determined the amount of invertebrates the swans are consuming.

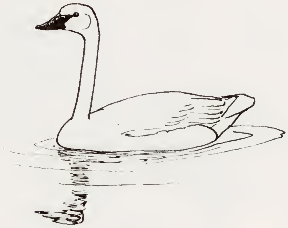
Five, 1 m^2 exclosures were established to help determine effects of swan feeding pressures on river habitat. These exclosures will remain in the river for the length of the study and will then be

evaluated in the same manner as the other sample sites.

A preliminary analysis of time budget data suggests swans spend over 50 percent of their time preening and resting, 15 percent feeding, with the remainder divided evenly between alert postures, threat postures, and locomotion. The main food source appears to be Potamogeton pectinatus and P. richardsonii, although so far we are unable to determine the amounts ingested.

For the remainder of the winter, we will continue to observe swan behavior. In the spring, we will begin the nest monitoring segment of the study. This will involve the use of infra-red photoelectric cells to indicate when a swan arrives at or leaves the nest, remote thermisters to monitor egg temperatures, and remote cameras to take pictures of each nest at present intervals.

[1] Krapu, G.L. and G.A. Swanson. 1975. Some nutritional aspects of reproduction in prairie nesting pintails. J. Wildl. Manage. 39(1):156-162.



CONSERVATION, EDUCATION, AND PUBLIC RELATIONS

B. W. O'Gara

30 July	Reviewed a four page manuscript for the *Journal of Mammalogy*.
31 July	Accompanied U.S. Bureau of Indian Affairs biologists on a flight of the Flathead Reservation to view potential sites for mule deer and goose studies with I. J. Ball.
6-20 August	Trapped pronghorns at Sheldon-Hart Mountain NWR, evaluating the potential of linear nets for possible future work on endangered Sonoran pronghorn.
21 August	Met with representatives of Missoula County and U.S. Forest Service regarding wildlife habitat planning on Grant Creek Ranch.
28 August	Toured Grant Creek, assessing possible impact of bridle trails and related developments on use of winter range by elk.
29 August	Met with personnel of the U.S. Forest Service, Friends of the Rattlesnake and a planner for Grant Creek Ranch, negotiating donation of critical winter range to management agencies.
3 September	Met with Montana Fish, Wildlife and Parks Director Wambach to discuss research needs of the Department and possible approaches to improved funding for the Unit.
5-7 September	Participated in Advisory Board meeting, Charles M. Russell NWR, Lewistown.
10-13 September	Attended the 69th Conference, International Association of Fish and Wildlife Agencies, West Yellowstone, Montana, with I. J. Ball.
18 September	Hosted a meeting on effects of Compound 1080 used in control of ground squirrels. Attendees included representatives of Montana Department of Fish, Wildlife and Parks, State Department of Agriculture, and Livestock Board.
19 September	Met with Grant Creek Developers, discussing protection and management of elk winter range on the project.

10 October	Attended a meeting in Helena with M.S. student Malloy on effects of 1080 used in control of Columbian Ground squirrels. Attendees included representatives of Montana Department of Fish, Wildlife and Parks and Montana Departments of Agriculture and Livestock.
11 October	Helped to plan a controlled burn to improve big game habitat on Forest Service land adjacent to Missoula.
15 and 18 October	Toured Grant Creek Ranch to assess possible impacts of bridle and ski trail developments on wintering elk.
16 October	Lectured to UM sophmore Zoology class on large carnivores and ungulates.
17 October	Collected and necropsied a mule deer for a senior wildlife class.
19 October	Met with B.I.A. and Tribal biologists to plan a mule deer study on the Flathead Reservation.
28 November	Met with developers and conservation interests regarding elk habitat on Grant Creek.
30 November	Attended Tribal Council meeting of the Confederated Salish and Kootenai Tribes with I. J. Ball and graduate student Yeager.
4 December	Met with officials of the National Wildlife Federation and was named to the advisory board for elk research and management on NWF elk range in the Rattlesnake Area.
5 December	Lectured to senior Wildlife Biology class on efforts to preserve elk winter range in the Grant Creek Area.
6 December	Lectured to the freshman careers course on Unit program and careers in the USFWS.
7 December	Met BIA and Confederated Salish/Kootenai Tribal biologists to discuss cooperative research on the reservation with I. J. Ball.
12 December	Attended a Wildlife Society workshop on problems related to anti-hunting sentiments.

13 December	Consulted with the manager of the Kofa Game Range concerning research on Sonoran pronghorn at Cabeza Prieta.
16 December	Met with NWF officials to discuss a clinic on environmental law. The clinic is a joint effort between NWF and the UM Law School.

I. J. Ball

9-13 July	Attended a workshop on management plans for Pacific Flyway Geese, Jackson, Wyoming.
15-30 July	Reviewed a 350 page manuscript for the U.S. Forest Service.
8-10 August	Attended Region 6 Mammals Program research meeting at Ft. Niobrara.
29 August	Met with Region 1 personnel, USF&WS, in Portland to discuss Columbia Basin wintering mallard research.
17 October	Participated in a training session for volunteer workers at MT F.W.P. game check stations.
23 October	Attended a 1080 meeting in Missoula with M.S. student Malloy.
6 November	Discussed Unit research programs at Flathead Reservation Wildlife Research Workshop.
13 November	Lectured to UM sophomore Zoology class on waterfowl and gallinaceous birds.
26 November	Met with David Marshall to discuss possibilities of employment and/or further education for Indian graduates of a wildlife technology program at Salish-Kootnai Community College.
3 December	Lectured to senior Wildlife Biology class on waterfowl ecology/management.

C. Jonkel

6 July	Talked to Ohio High School Group, U. of M. Campus, on bear research.

11 July	Presented talk on E. Greenland polar bear studies at U. of M. Biological Station.
12 July	Lectured to Mammalogy Class, U. of M. Biological Station re bears of North America.
26-28 July	Hosted and attended Border Grizzly Technical Committee annual workshop and meeting, Whale Creek, North Fork of the Flathead.
6 August	Presented talk to Cabinet Ranger District personnel on grizzly studies.
12-13 August	Aided Glen Lau Film Associates in the production of Montana wildlife segment of ABC Sports series.
16 August	Did interview with KPAX re grizzly studies.
29 August	Joined USFS tour of endangered and threatened species habitat, North Fork.
9-10 September	Attended International Wildlife Conference, West Yellowstone, presented information on grizzlies.
24 September	Outside examiner, UBC M.Sc. exam (Kevin Lloyd), re B.C. coast grizzly study.
25 September	Gave seminar to Simon Fraser University, Burnaby, B.C.
18 October	Met with BLM, Butte, re East Front Grizzly studies.
30 October	Attended Grizzly Recovery Plan meeting, Spokane.
5 November	Attended BGP, BLM, FWP, Yellowstone Study Team meeting re East Front studies, Bozeman.
14 November	Game seminar in F475 wildlife class.
15 November	Gave talk to Flathead Chapter, Montana Wilderness Association, Kalispell.
30 November	Met with USFS, FWP personnel, Cabinet Ranger Station.
6 December	Testified at grizzly trial, Newport, Washington.
7 December	Attended Yellowstone Grizzly Recovery Plan meeting, Missoula.
8 December	Attended Montana Wilderness Association meeting, Kalispell.

12 December	Attended Montana Chapter, The Wildlife Society, Missoula.

C. Servheen

19 July	Conducted a tour of grizzly habitat and den areas in Mission Mountains for Schneegas and Gale of the U.S.F.S. Regional office.
20 July	Conducted a tour of grizzly habitat and use areas on Burlington Northern lands in the Swan valley for Hicks of Burlington Northern.
26-28 July	Attended Border Grizzly Technical Committee meeting at Whale Creek Community Center, Montana.
2 August	Met with officials of Seattle City Light for consultation on a study plan to access effects of a proposed dam on a wintering Bald Eagle population.
6 August	Spoke to BIA-FWS meeting on grizzly research in Mission Mountains.
10 September	Attended Conference of International Game and Fish Commissioners in West Yellowstone, Montana.
26 September	Attended meeting on critical habitat of Grizzly and Wolf as a participant of F.S. Region one headquarters.
8-13 November	Attended Raptor Research Foundation meeting in Sacramento, California.
15 November	Conducted part of a workshop on assessment of wintering Bald Eagle populations for BIA-FS joint meeting in Ronan, Montana.
16 November	Lectured to Wildlife 475 class on Biotelemetry and techniques.

S. Albert

Attended Fall Rendevous of the Montana Trappers' Association.

Attended Bobcat Research Conference at Front Royal, Virginia.

L. Young

	Conducted informal telemetry training session for Glacier National Park SCAs, VIPs, and Interpretive Division personnel.
	Reviewed Glacier National Park Research Division publication on Bald Eagles and kokanee salmon.
	Spoke on research objectives, techniques, and applications to media (4) and Glacier National Park visitor groups (5), including University of Montana natural resource management class field trip.
	Spoke on research objectives, techniques, and applications to U.S.D.I., National Park Service regional and local adminstrators.
	Attended periodic Glacier National Park natural resource presentations to answer questions on Bald Eagles and research objectives, techniques, and applications.
5 December	Participated in Telemetry Workshop at Montana State University, Bozeman.

S. Martin, J. Parker, L. Kopec, and D. Daneke

	Participated in the U.S. Fish & Wildlife Service's 1979 Preseason Waterfowl Banding Program in August. This was Martins second year in the program and she was selected as a crew leader.

D. Pond

17 December	Presented a slide show and lecture on predation to the American Association of Zoo Keepers, Lincoln Park Zoo Chapter, Chicago, Illinois.

J. Malloy

11-15 July	With R. Hompesch, R. Levesque, H. Neckles, D. Pond, and D. Weybright presented a series of conservation lectures and training sessions for Youth Conservation Corps work crews.

10 October	Gave a slide show to the Sentinel High School Science Research Society.

D. A. Jenni

10-15 June	Attended the Animal Behavior Society meeting at Tulane University, New Orleans.

A. Sheldon

November	Attended meeting of the Entomological Society of America in Denver. Presented invited paper "Comparative Zoogeography of Stoneflies in the Rockies, Sierra Nevada and Great Basin" in a symposium "Aquatic Insects in the Rocky Mountains".

A. Lester

August	Gave two presentations on "Woodpeckers and Mountain Pine Beetle" to Glacier National Park visitors and seasonal staff.
27-30 November	Presented paper on "Numerical Response of Woodpeckers and Their Effect on Mountain Pine Beetles in Lodgepole Pine in Northwestern Montana" at Second Conference on Scientific Research in the National Parks in San Fransisco.

P. L. Wright

Appointed by The Wildlife Society President to the Conservation Education Awards Committee.

Appointed by the President of the National Rifle Association to the Grants-in-Aid Committee (Awards grants to graduate students for wildlife related research projects).

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BIANNUAL REPORT

of the

MONTANA COOPERATIVE WILDLIFE RESEARCH UNIT

University of Montana
Missoula, Montana

to

UNIVERSITY OF MONTANA
MONTANA FISH, WILDLIFE, AND PARKS COMMISSION
WILDLIFE MANAGEMENT INSTITUTE
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Respectfully submitted,

Bart W. O'Gara
Bart W. O'Gara, Leader

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MONTANA COOPERATIVE WILDLIFE RESEARCH UNIT PERSONNEL

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Montana Fish, Wildlife, and Parks Department
Wildlife Management Institute
U.S. Fish and Wildlife Service

Alaska Fish and Game Department
Alberta Fish and Wildlife Branch
Arctic Petroleum Operators Association
Audubon Society
Bitterroot National Forest
Border Grizzly Project
British Columbia Wildlife Branch
Bureau of Indian Affairs
Bureau of Land Management
Canadian National Sportsmen's Shows
Canadian Wildlife Service
Churchill Northern Studies Centre
Denver Wildlife Research Center
Environmental Research Institute
Flathead National Forest
Friends of the Rattlesnake
Idaho Cooperative Wildlife Research Unit
Idaho Department of Fish and Game
Interagency Grizzly Bear Team
Maine Department of Inland Fisheries and Wildlife
Manitoba Department of Mines, Resources, and Transportation Services
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Montana Power Company
National Bison Range
National Geographic Society
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Nature Conservency
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Nevada Department of Fish and Game
New York Zoological Society
Norsk Polarinstitutt
Northwest Territories Fish and Wildlife Service
Parks Canada
Quebec Wildlife Service

Salish Kootenai Tribal Council
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University of Alaska
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University of Guelph
University of Maine
University of Montana Foundation
University of Oslo
Washington Fish and Game Department
Wildlife Federation
World Wildlife Fund (Canada)
Wyoming Game and Fish Department
Yellowstone National Park

RESEARCH PROJECTS

Physiologic and Ecologic Studies of the Pronghorn (*Antilocapra americana*)

Project Leader: B. W. O'Gara
Cooperators: National Bison Range, U.S. Fish and Wildlife Service; Yellowstone National Park, U.S. National Park Service; and the Montana Fish and Game Department

Objectives:

To study:

1. the reproductive physiology of male and female pronghorn;
2. the physiology and function of scent glands;
3. food habits related to changes in range conditions;
4. horn growth and casting; and
5. the relationship of pronghorns to other artiodactyls.

Results:

Work was continued on the pronghorn book.

A Mountain Lion (*Felis concolor*) Study in Western Montana

Project Leaders: B. W. O'Gara and K. G. Greer
Cooperator: Montana Fish and Game Department

Objectives:

To mark a large number of mountain lions and attempt to determine:

1. how heavily lions are harvested in western Montana;
2. aging criteria from marked kittens as they are trophied at a later time; and
3. movements of lions.

Results:

Radio collars are being secured for use in the Fish Creek Drainage during winter 1979-80.

Fawn Mortality in the Upper Pahsimeroi River Valley Pronghorn Herd

Project Leader: B. W. O'Gara
Student Investigator: W. Bodie
Cooperator: Idaho Department of Fish and Game

Objectives:

1. To determine causes of fawn mortality.
2. To relate condition of fawns at birth to fawn survival.
3. To relate fawn survival to range conditions:
   - a. to habitat type;
   - b. to vegetative successional stages;
   - c. to plant phenology; and
   - d. to climatological conditions.

Results:

The student investigator completed his thesis. The summary follows.

A study to determine the factors affecting fawn mortality of a native, unrestricted pronghorn population was conducted in the upper Pahsimeroi River Drainage of central Idaho. During the fawning seasons of 1976, 1977, and 1978, neonatal histories were gathered for 42 fawns through the use of radio-telemetry. Adult summer condition trends were monitored using data gathered from 101 pronghorns killed by hunters from 1975 through 1978. Range condition, trend, and spring-summer food habits were determined.

By 1 September, 62% of all marked fawns were dead, and 92% of all mortality occurred during the first 2 weeks after birth. Mortality rates, determined from marked fawns, ranged from 47 to 83% and were representative of that observed for the rest of the population. The failure to remove non-producing yearling does from late summer herd composition information affects the accuracy of these data. The greater the number of yearling does in the population, the greater the underestimate of fawn survival. Total mortality was high during those years when heavy losses to predation and disease occurred concurrently.

Predation was the most important mortality factor accounting for 35.7% of all marked fawns and ranged from 12 to 58%. Eagles were the most successful predators and accounted for

approximately 50% of all predator-caused mortality. Larger, more active fawns were more susceptible to predation than smaller, less precocious fawns. Does actively defended fawns from coyote and eagle attacks and were usually successful. Fawns bedding in the tall sage-foothill community type were more susceptible to predator-caused mortality than fawns bedding in the short sage-flat type. Most predator sightings, kills, and all coyote dens and eagle eyries were located in the tall sage type.

Does preferred the short sage-flat community type for birth sites and most fawn bedding sites were located in this type during late May and early June. Fawns were moved toward the tall sage type during June and by late June-early July most fawns were bedding in the tall sage type. The short sage flats were nearly abandoned by all age and sex classes by 1 August.

Pahsimeroi does were more likely to abandon fawns during some years than others. Stress on the mother-young bond from human harassment, adverse weather conditions, predator kills of siblings, disease, livestock, and imprint confusion from the presence of yearlings at birth sites was observed.

During some years, Pahsimeroi fawns were subject to losses from weak fawn syndrome. Observed symptoms were: (1) general weakness; (2) susceptibility to hypothermia; (3) early mortality; (4) secondary enteritis; (5) swollen livers and spleens; (6) edema, fibrin, and hemorrhaging in hock joints; (7) enlarged and edematous suprascapular and prefemoral lymph nodes; (8) rough and dry coat; and (9) atrophic thymus glands.

Shrubs had a consistently higher moisture content than forbs and forbs had consistently higher moisture content than grasses. During September, adult pronghorns used forage at the following percentages: shrubs 68, forbs 23, and grass 4. Food habits for the spring period were similar to that of September; thus, pronghorns selected the most succulent forage.

Pronghorns were of normal size for this latitude. Eviscerated and total kidney fat weights indicated a high yearly variation in fall condition. Rutting bucks had only small quantities of food in their rumens. Lactating does had

minimal fat reserves and often appeared emaciated. Three instances of multiple ovulation periods were observed in emaciated does. The effect of the possible problem in conception on net productivity is unknown.

The upper Pahsimeroi River Drainage is marginal pronghorn range. The high altitude and low spring-summer precipitation adversely affect forage production and, subsequently, fall pronghorn condition. Yearly total forage production and phenological development was highly variable. The tall sage community was more productive and had more succulent vegetation during all periods and for all forage classes than the short sage-flat type.

Livestock use has increased grass, forb, and shrub production and diversity in the short sage type. Forbs were largely absent in an ungrazed portion of this type. Grazing has reduced the amount of bluebunch wheatgrass and increased the production of Sandberg bluegrass. The amount of grazing pressure needed to produce the optimum ratio of grass, forbs, and shrubs for pronghorns is unknown.

Mammalian Utilization of Floodplain Habitats Along the North Fork of the Flathead River, Montana

Project Leader:	P. L. Wright
Student Investigator:	C. Key
Cooperator:	U.S. National Park Service

Objectives:

1. To establish plots on the floodplain from which estimates will be made of small mammal densities in the seral vegetative stages present.
2. To determine rates of immigration onto newly exposed land after flooding.
3. To conduct winter surveys of medium-sized mammals utilizing floodplain habitats.
4. To explore possible relationships between the small mammal fauna of the floodplain and wider ranging carnivores which may use the area as a food source.

Results:

The student investigator completed his thesis. The summary follows.

Small mammal communities along the North Fork of the Flathead River Floodplain in Glacier National Park, Montana, were investigated during 1976 and 1977. A data base was established to provide a descriptive framework of mammalian Floodplain utilization under natural conditions, so that GNP resource managers might better assess the future impact of human disturbance.

A habitat typing scheme was developed to facilitate the comparison of small mammal population parameters between areas of different vegetation and substrate. Riparian habitats of the Floodplain formed a continuum of seral stages between vegetation-free WASH GRAVEL sites and forested PICEA/ EQUISETUM stands. Results of the habitat analysis were necessarily complex, given the variety of recognizable types. Seventeen habitats were described, of which six occupied areas adjacent to the Floodplain. Habitat types were assembled into the following four habitat groups representing more general and easily identified phytogenic associations: wash, cottonwood, conifer, and grassland.

Twelve species of small mammals, representing five families and 10 genera, were trapped on six NFFR Floodplain plots. One species, Microsorex hoyi, was a new record for GNP. An additional seven species were recorded through actual or track sightings. Most small mammal species were permanent residents; only two, Spermophilus columbianus and Thomomys talpoides, were transient.

Peromyscus maniculatus was the most abundant small mammal on all plots, and usually contributed over 50% to the total catch. Generally two additional species, either Clethrionomys gapperi, Microtus longicaudus, Zapus princeps, or Eutamias amoenus were codominant with Peromyscus on any given plot. Species richness ranged from 3 to 9 on the four snap trap plots, and averaged 7.50 in 1976 and 4.75 in 1977. From 3 to 7 species were captured on the two live trap plots.

Statistically significant differences existed between the small mammal faunas on plots. Sources of inter-plot variation included the habitat pattern on Floodplains, the composition of communities adjacent to the Floodplain, and other factors which might have strictly local influence. Plots which contained or bordered coniferous forest usually supported larger populations of C. gapperi and Sorex sp., than did plots

adjacent to grasslands. The latter were characterized by greater relative dominance of Microtus longicaudus. During one live trap period, competitive dominance was evoked to explain the progressive reduction of P. maniculatus and expansion of M. longicaudus populations.

Total small mammal catch rate was lower in 1977 than in 1976. Clethrionomys gapperi, Sorex sp., and Microtus longicaudus were significantly less abundant during the second year. As well documented phenomena, small mammal population fluctuations were anticipated. In this case, snow conditions during the intervening winter provided insufficient insulation and most likely increased mortality. The harsh winter also negatively affected species diversity by eliminating scarce species from the Floodplain. More ubiquitous species, or species well adapted to Floodplain habitats (e.g., P. maniculatus and E. amoenus) remained established, however.

Floodplains provided suitable habitat for small mammals, and were highly productive. Both density and biomass were greater in wash habitats than in most other types, including adjacent communities not subject to periodic flooding. Young seres were characterized by low species diversity, and high relative abundance of P. maniculatus. Conversely, older coniferous seres supported more species and total small mammal abundance, though similar to early seres, was more equally distributed between the species present. As a further indication of the preference for wash habitats by some small mammals, Peromyscus and Eutamias recovered on flooded areas soon after water receded. Reproduction of resident adults accounted for most of the population growth on wash sites, and juvenal immigration was polarized toward the older, less frequently flooded seres which initially contained fewer small mammals.

The immediate effects of flooding on Floodplain small mammals are probably ephemeral, and indirect effects, though longer lasting, may actually benefit some species. Flooding causes the redistribution of organic litter into piles of debris which provide adequate shelter and nest sites. As waters recede, silt, sand, and soil nutrient deposits predispose Floodplains to high rates of plant production that are conducive to supporting relatively large numbers of small mammals.

Furbearers and other medium-sized mammals were track censused during the winter of 1976-1977. Poor snow conditions

resulted in moderate tracking success. Twelve species were recorded and only one, Martes americana, was not encountered on the Floodplain. Mustela erminea was the most abundant carnivore in each habitat group. Mustela vison and Lutra canadensis associated closely with water courses, and rarely ranged beyond river or stream banks. Floodplains and nearby river ice provided frequently traveled routes for Felis concolor. I encountered few instances of actual predation on the Floodplain. However, the amount and pattern of predator activity suggested greater utilization of Floodplain food resources than indicated by direct observation.

The Breeding Ecology of the Trumpeter Swan (Olor buccinator Richardson) in Yellowstone National Park, Wyoming

Project Leader:	B. W. O'Gara
Student Investigator:	R. Shea
Cooperator:	Yellowstone National Park

Objectives:

The primary objectives of this study are to:

1. locate all swans which attempt to nest in Yellowstone and determine the chronology and rates of nest desertion, nest failure, and cygnet mortality;
2. evaluate human use in the vicinity of nest sites;
3. quantify the breeding behavior of swans, particularly of pairs which are exposed to different levels of human activity;
4. examine environmental factors for correlations with nest success; and
5. devise a practical system to monitor swan productivity and human disturbance.

As time permits, efforts will be made to:

1. observe interspecific interactions between swans and potential predators;
2. recover dead cygnets, adults, and abandoned eggs to examine for physical abnormalities, causes of death, and standard measurements;
3. to supplement and update Banko's (1960) reconstruction of the population dynamics of Yellowstone's swans; and
4. locate and identify neck-collared and banded swans among those assembling in the Park during autumn and determine the species of those birds.

Results:

The student investigator completed her thesis. The summary follows.

The ecology of nesting and migrant Trumpeter Swans in Yellowstone National Park (YNP) and vicinity was studied from September 1976 to April 1979. The primary objectives were to: assess the current status of Trumpeters in the study area, identify the causes of low cygnet production, determine whether human activities reduce cygnet production in YNP, and follow the movements of neck-banded migrant Trumpeters.

The 6400 km^2 study area contained 30 nesting pairs of Trumpeters, roughly 33% of the breeding population of the entire Tri-state Region. The 21 pairs found nesting in YNP represent approximately a 50% increase compared to the previous high count of 13 breeding pairs in 1939 (Condon 1941).

During 1977 and 1978 combined, clutch sizes averaged 4.21 eggs at 33 nests and was significantly reduced to 3.80 eggs per nest in 1978. Cold weather and heavy snowpack delayed nest initiation in 1978 from 1 to 3 weeks at most territories.

The estimated hatching rate of eggs was 49%. Nesting success varied from 71% in 1977 to 41% in 1978. Losses to flooding during the peak runoff in late May and the infertility of three complete clutches accounted for much of the 1977 decrease.

Six of the 48 nesting attempts were abnormal. In five cases the adults nested but failed to lay eggs; two pairs had this difficulty both in 1977 and 1978. The sixth case involved two females that paired, and each laid and incubated an infertile clutch of five eggs.

At six nests, the pattern of incubation was quantified via time-lapse photography. The three nests that fledged young contained larger clutches than the three nests that failed, and the successful females incubated with greater constancy, greater session length, shorter recesses, and fewer recesses per day than did their unsuccessful counterparts. These "better" incubators also had a higher hatching rate of eggs and higher cygnet survival. Multiple regression analysis showed

that variation in the number of recesses per day and in session lengths accounted for 89.17% of the variability in the number of cygnets hatched, and 68.54% of the variability in the number of cygnets fledged.

Although incubation patterns were quantified at only six nests, the positive relationship between increased clutch size and increased cygnet survival was true throughout the study area. Cygnets from clutches of four or fewer eggs suffered 90% mortality, with a complete loss of 75% of the broods. Cygnets from clutches of five or six eggs suffered 69% mortality, with a loss of 42% of the broods. Clutch size normally is reduced among birds nesting for the first time, or when the female is in poor physical condition. At each territory, clutch size either remained the same or decreased from 1977 to 1978; a combination of the late spring and the females' poor condition were probably more important factors in this reduction than the females' ages.

Mean brood size at hatching was 1.8 cygnets per active nest. Of the 87 cygnets that hatched, 66 (76%) died prior to fledging. These deaths included the complete loss of 15 of the 26 broods. Virtually all mortality occurred within the first 6 weeks of life. Necropsies on nine cygnets could not determine the cause of death. Moribund cygnets showed overall weakness, leg and foot deformities, and rapid flicking of the head. Twenty-two percent of the cygnets that survived to September were retarded in development.

The hatching success of only 49% and the very high cygnet mortality prior to fledging were the major causes of the virtual lack of cygnet production in the YNP vicinity.

Human activity in YNP was the most important obstacle to successful nesting at Shoshone and Grebe lakes, and greatly reduced the chances of successful nesting at "Beach Spring Lagoon." Each territory lacked a suitable nesting island and the historic nesting site was on the shoreline where it now is extremely vulnerable to vandalism or unintentional disruption by humans.

Cygnet production did not vary significantly between disturbed and undisturbed territories. However, swans were more likely to be present at disturbed territories without nesting, or to be absent entirely, than they were at undisturbed territories. The

number of nests established per territory, per year, was 0.91 at undisturbed territories and 0.69 at disturbed. Thus, the effects of disturbance are subtle. The swans that can habituate to human disturbance will suffer no reduction in nesting success (unless vandalism or a similar extreme event occurs), but disturbed territories will support fewer nesting attempts.

Between 300 and 450 migrant Trumpeters visited the Yellowstone Lake area from October to December. Most of these swans came from outside the Tri-state Region and represented most of the known Canadian breeding population. At least 69 different neck-banded Trumpeters from Grande Prairie, Alberta, passed through the area during the study.

As Yellowstone Lake froze, the swans moved south and west to join other migrants and year-round residents on the Henry's Fork of the Snake River, in and near Harriman State Park. Although a few scattered swans wintered throughout the Tri-state Region wherever slow moving, ice-free water existed, Harriman State Park provided winter habitat of unparalleled importance. Between 500 and 600 Trumpeters congregated in the Park during the coldest periods when most other areas froze. Most of the Canadian migrants used this site; less than a dozen neck-banded Trumpeters were detected wintering at Red Rock Lakes NWR.

The winter concentration of up to 68% of the Mid-continental Trumpeters on less than 16 km of river presents a situation with high potential for either habitat depletion or the rapid spread of disease. Dispersal of wintering swans is necessary to provide a reasonable degree of security.

The water flow through Harriman State Park is controlled at the Island Park Dam. Manipulation of water releases to prevent freezing of the wintering site could be a valuable management tool to benefit the wintering swans.

In excess of 50 feral Mute Swans presently inhabit the Tri-state Region. Their continued increase and range expansion raises the threat of competition and possibly hybridization with the native Trumpeters. A Mute Swan, paired with a Trumpeter, was seen on two occasions.

At the current rate of reproduction (0.44 cygnets fledged per active nest), swans in the study area require 22 years to

replace the pair unit. Region-wide production since 1968 equaled an estimated 1.1 cygnets fledged per active nest, a rate which will require 8.8 years to replace the pair unit.

Between 1964 and 1968, the Regional adult population decreased by 22%. In the last decade the decline has slowed and approached an apparent equilibrium of between 405 and 445 adults, but this leveling off probably is temporary. From the best available census figures and estimated age-specific survival rates, the population is not reproducing adequately to replace itself.

Both mortality data from the Canadian neck-banding studies, and the positive relationship between low clutch size, lowered attentiveness during incubation, and reduced cygnet viability found in this study point to poor physical condition of swans as they leave the wintering areas. Winter competition for limited food resources is a likely cause of the present problems.

Because of the greater stresses placed upon nesting birds by the rigorous, high elevation environment of YNP, factors that affect the reproductive success of swans throughout the Region may be felt most acutely in the Park. The current lack of successful reproduction in the study area seems to reflect a Regional density-dependent phenomenon that is causing infertility, small clutches, low hatchability, and high cygnet mortality. Further research is needed to determine the mechanisms involved. Concern is warranted because of the population's current inability to replace itself.

Vegetation of Grizzly Bear Habitat in the Selway-Bitterroot Wilderness Area

Project Leader:	B. W. O'Gara
Student Investigator:	G. Scaggs
Cooperators:	U.S. Forest Service, Wildlife Management Institute

Objectives:

1. To habitat type the forest vegetation employing the method of Pfister et al. 1977.
2. To type map the non-forested temperate, subalpine and alpine vegetation employing the methods of Craighead et al. 1976.

3. To consolidate vegetation types into large vegetation complexes using the method of Craighead et al. 1976 and rate them in importance value to the grizzly bear.
4. To make quantitative measurements of the major grizzly bear plant foods and relate these estimates to the vegetation complexes.
5. To record black bear and possible grizzly bear use of plant foods within the study area and to make a rough estimate of population density for each species.
6. To analyze the data recorded in objectives 1-5 to determine whether the Selway-Bitterroot Wilderness meets basic habitat requirements for grizzly bears.

Results:

The student investigator completed his thesis. The summary follows.

Within a 40 square mile (104 km^2) study area of the Selway-Bitterroot Wilderness Area, vegetation in ecological landtypes and forest habitat types of the subalpine and temperate zones was sampled to evaluate potential grizzly bear habitat. From the descriptions of vegetation, the abundance and distribution of grizzly bear food plants were compared to other vegetative components to determine if vegetation limited bear numbers in the study area.

Of seven ecological landtypes in the subalpine zone, the Dry Forb Grasslands had the most grizzly bear food plants (72.0%) and the widest variety (23 components). Xerophyllum tenax, Vaccinium scoparium, V. globulare, and Carex spp. were the most abundant.

The Abies lasiocarpa/Luzula hitchcockii-Vaccinium scoparium forest habitat type had bear food plants comprising 79.9% of the ground vegetation. It had the greatest potential for bear food plants of the four major habitat types in the subalpine zone. Xerophyllum tenax, Vaccinium scoparium, and V. globulare were the most abundant species.

Food plants in the seven ecological landtypes of the subalpine grass-shrublands represented 61.5% of the ground vegetation. Xerophyllum tenax, Vaccinium scoparium, and species of Carex and Juncus were the most abundant and widely distributed food plants.

Total grizzly food plant composition in the subalpine forests was 56.6% with Xerophyllum tenax, Vaccinium scoparium and Erythronium grandiflorum the most abundant and widely distributed plants.

Pinus albicaulis was a unique energy source in the subalpine zone and a major component of the forest canopy where it accounted for 23.8% of the cover.

The temperate grass-shrublands were represented by six ecological landtypes. In the Seral Stages (Burns) grizzly food plants represented 94.6% of the ground vegetation. However, Xerophyllum tenax, a documented but low priority food, was 57.7% of the ground vegetation. Vaccinium scoparium, Carex geyeri, and V. globulare were other major food plant components. The Dry Forb Grasslands were similar to the same landtype in the subalpine zone. Twenty-nine food plants represented 75.5% of the ground cover.

Of the four major forest habitat types in the temperate zone, only one had grizzly food plants comprising over 40% of the undergrowth. The preponderance of moist and dense-canopy forests precluded the occurrence of many food plants. Undergrowth in the Abies lasiocarpa/Xerophyllum tenax-Vaccinium globulare forest habitat type was composed of 88.9% food plants. X. tenax, V. globulare, and V. scoparium were the major components.

Food plants in the temperate grass-shrublands represented 58.8% of the undergrowth. Dominant plants were Xerophyllum tenax, Carex spp., Carex scopulorum, Calamagrostis canadensis, and Vaccinium globulare.

Within the temperate forests, 45.1% of the ground vegetation was grizzly food plants. Xerophyllum tenax, Vaccinium globulare, and V. scoparium were the most abundant and widely distributed.

Evaluation of both the subalpine and temperate zones resulted in rating the subalpine as superior grizzly bear habitat. The evaluation was based on the abundance of grizzly bear food plants in relation to land area. The study area was good grizzly bear habitat from the standpoint of vegetation, and the vegetation was not a limiting factor affecting bear numbers.

To accurately rate potential grizzly bear habitat and its components, additional knowledge is needed concerning grizzly bear selectivity and preference with regard to vegetation. Analyses of food plant diversity, concentration, and nutritional parameters are currently under investigation and the results should be incorporated into a rating of specific food plants. To rate potential habitat as a reintroduction site, as it should be for the Selway-Bitterroot Wilderness, additional values can be incorporated into the data base. By comparing food and landtype importance values from a variety of potential "donor" areas to the potential site, the "donor" population best suited for existence in the new area could be identified.

I assert that potential grizzly bear habitat can be identified and its components evaluated and rated without a bear population present. As studies are completed in areas currently supporting grizzly bears, evaluating the Selway-Bitterroot as a potential reintroduction site will be possible.

A Study of Pesticide Residues and Heavy Metals in Whistling Swans (*Olor columbianus*)

Project Leader:	R. Erickson
Student Investigator:	E. Fite
Cooperator:	Montana Fish and Game Department

Objectives:

1. To determine pesticide and mercury levels in Pacific-flyway Whistling Swans.
2. To determine at least three age classes and sex ratio of swans killed at Freezout Lake.

Results:

The student investigator completed his thesis. The summary follows.

This study was undertaken to gain insight into the significance of lead, mercury, and organochlorine pesticides in Whistling Swans.

Forty-five Whistling Swans were taken as a sample while migrating through Montana in the spring and fall of 1973 and analyzed for these chemicals. In addition, seven swan eggs

were collected on breeding grounds in Alaska and analyzed for mercury and organochlorine pesticides.

Elevated concentrations of lead were found in seven of the 45 swans sampled. In the spring sample of 15 swans, one had liver tissue levels indicating acute lead poisoning, three had one lead pellet each in its stomach, and one of these three had elevated lead levels in wing tissue indicating previous lead intoxication. In the fall sample of 30 swans, two had elevated lead levels in wing tissues indicating previous lead intoxication and one had a lead pellet in its stomach. The incidence of lead found in swans is greater than that found in other waterfowl throughout the United States, but lower than revealed in studies confined to more localized wintering areas.

Mercury residues in Whistling Swan tissues and eggs were less than 0.6 ppm in all samples. In comparison to other monitoring studies of mercury in waterfowl, levels found in swans fall in the lower range of contamination. Given present knowledge, these mercury levels indicate minimal adverse effects on swans.

Organochlorine pesticide residues were present in all samples at extremely low levels (less than 0.2 ppm). DDE and dieldrin were the most frequent pesticides found. Although reasons for the low levels are only speculative, such levels could be due to feeding habits, physiology, or history of exposure. Amounts found are well below quantities known to be detrimental to other avian species.

The collection of specimens for this study provided an opportunity to examine sex and age variations in this species.

The eight measurements taken during initial examination showed that, although males averaged larger than females of the same age class, the difference between most of the measurements was not statistically significant. With the possible exception of wing length, none of the measurements showed promise for discriminating between sexes.

Between age classes in the fall sample, adults averaged larger than immatures and the differences between several of the measurements were statistically significant. In the spring sample, similar trends were not as apparent; however, sample size precluded meaningful interpretation. The only

measurements taken which showed promise to verify age estimates from plumage color were fall bill length and fall and possibly spring bursa depth.

Vaccinium Distribution and Productivity Study

Project Leader:	C. Jonkel
Student Investigator:	Patricia Martin
Cooperators:	U.S. Forest Service, U.S. Fish and Wildlife Service, Montana Fish and Game Department, and U.S. Park Service

Objectives:

1. To gather data on the distribution of Vaccinium globulare, V. membranaceum, V. ovalifolium, and V. myrtilloides.
2. To determine the effects of certain physical factors (slope, aspect, etc.) and fire and logging on berry productivity.

Results:

The student investigator completed her thesis. The summary follows.

Berry production of globe huckleberry shrubs in northwestern Montana was determined by interactions between a site's physical and vegetative characteristics, and the stand history. Site disturbance by clearcutting and burning 8 to 15 years ago, or by natural fires 25 to 60 years ago on mesic north- or east-facing slopes induced changes which resulted in increased fructification, percent cover of globe huckleberry shrubs, the number of berries per plant, and the average berry volume. Production decreased if sites with southern or western aspects were clearcut and/or burned, or if clearcuts on any aspect were scarified.

The effects of elevation and topography on berry production were visible only within areas where the site history was uniform. Then production and percent cover of huckleberry shrubs increased with changes in topography and elevation to 2050-2120 m (6750-7000 ft). Above that elevation, or on ridges, fructification and cover were limited. Huckleberry shrub height decreased in plots from lower slopes to ridges on the same site. The cover and production presumably responded positively to decreases in competition, but height responded negatively to the increase in stress.

Shrub height increased as the thickness of the tree canopy increased, but cover, production, the number of berries per plant, and the average berry size were limited if the tree canopy was more dense than 30%. Huckleberry shrub cover was limited by competition; production by available light. Thus, when the tree layer was removed by a natural fire or a clearcut, and competition from other shrubs reduced by fire that did not destroy the huckleberry rhizomes, fructification increased if moisture was adequate.

Dense understory cover of any species limited productivity and cover of huckleberry shrubs. Dominance of one species or another did not depress or increase production or cover, but huckleberry shrubs were short if beargrass was dominant and tall if menziesia was. Apparently, height responded to changes in moisture, and cover and production, again, to competition.

Fructification was not related to the percent cover or height of the huckleberry shrubs. In some stands, globe huckleberry is not entirely eliminated when the stand matures. If the mature stand is disturbed, the plants respond, but it is several years before berries are produced. Therefore, the globe huckleberry is a late-seral or climax species capable of continued existence on a disturbed site, whose fructification is meso-seral.

The more berries there were per plant and the larger the volume of the average berry, the more productive a site was. The average berry volume was less on xeric aspects than on mesic sites, but the number of berries per plant was not influenced by aspect. The flowers formed in the spring when moisture was adequate on most aspects. The berries increased in size in the fall when moisture could have been limited on southern or western aspects. Berry volume was also correlated with huckleberry plant height which responded positively to increases in moisture.

Berries for sugar analyses were collected when the berry plots were sampled. Because I tried to sample all plots at approximately the same stage of fruit maturation, there was no correlation between the collection date and berry sugar content. The small, numerous berries produced on high-elevation plots were sweeter than large berries from lower elevations. Questions about the effects of clonal variation or tree shade were not answered in this study.

Fructification in thinned stands was erratic. Prolific stands had high coverages of tall huckleberry shrubs and unproductive plots either had high coverages or tall shrubs, but not a combination of both characteristics. Otherwise, variation in productivity between selective cut sites with similar characteristics was unexplainable.

Year-to-year variation in production emphasized the impact weather has in annual berry crops. Three productive plots from 1977 produced very little fruit in 1978 because of late frosts or snowstorms. However, the effects were localized by drainage or elevation and berries were produced in nearby areas.

Diurnal black and grizzly bear use of berry-producing clearcuts in subalpine fir/queencup beadlilly-menziesia habitat types is apparently limited. Evidence of nocturnal use of clearcuts by grizzlies exists, but use by either species is probably limited until some shrub or tree cover develops. Conversely, grizzlies frequently use open, subalpine fir/beargrass-globe huckleberry types that were burned 25-50 years ago in the fall. Any type of logging and post-logging treatment in this habitat type reduced globe huckleberry shrub cover and fructification, so most bear use of the type by bears is probably in middle-aged wildfires. Inadequate sample size precludes a discussion of concrete results of different treatments in other habitat types identified as important for grizzlies by personnel of the Border Grizzly Project.

Hitchcock and Cronquist (1973) pictured the corolla of _V. membranaceum_ as longer than broad, and those of _V. globulare_ as broader than long. All the corollas of the flowers collected from _V. globulare-membranaceum_ type plants in western Montana, northern Idaho, eastern Washington, and northern Oregon were broader than long, or round. But, no flowers were collected from the type locality of _V. globulare_ or from the central range of _V. membranaceum_ in the Washington Cascade Mountains. Conclusions about the strength of the corolla character cannot be made until fresh flowers from western Washington are collected.

The leaves of most collected specimens were elliptic and half as broad as long, regardless of the geographic location of the collection, but the tips of the leaves from the midpoint

to the apex varied from site to site. Plants from Mount Hood, Oregon, and eastern Washington had gradually tapered leaf apices like those described for V. membranaceum. Plants from the Blue Mountains of Oregon had abruptly acute, V. globulare-shaped leaves (Hitchcock and Cronquist 1973).

Leaf shape also varied within sites or within plants. Leaves from plants collected in clearcuts were thicker and more abruptly acute than leaves from plants in adjacent, undisturbed stands. Within plants, leaves on resprout stems were larger and differed in shape from leaves on current annual growth stems. Terminal leaves or third and fourth leaves with flowers in their axils were smaller and had more irregular shapes than second or third, flowerless leaves on the same stem.

Two uncommon leaf shapes were discovered. A round-leaf form of V. globulare was found in isolated areas in western Montana and northern Idaho. Both cases were associated with V. globulare plants, but had separate rhizome systems. A V. membranaceum plant with exceptionally serrated leaf margins was found in one location in eastern Washington.

V. globulare-membranaceum-type plants in northern Idaho were more variable than those of Oregon. Some areas had leaves with gradually tapered apices, others were abruptly acute or intermediate in shape. Shapes of western Montana leaves were also diversified, though none had the consistent, gradually tapered apices of V. membranaceum.

Two other species of Vaccinium were reviewed in this study. V. ovalifolium is found in northern Idaho and in British Columbia about 50 km (30 miles) north of the Canada-Montana border. Even after intensive searches, I did not find it in northwestern Montana.

A population of V. myrtilloides exists near the west entrance of Glacier National Park. No other locations of the species were found in western Montana. It is possible the population is the result of seed dispersal and was vegetatively propagated in the area, but it could occur in other parts of the Park.

Bear-Livestock Encounters--Targhee National Forest

Project Advisor:	C. Jonkel
Student Investigator:	C. Jorgensen
Cooperators:	U.S. Forest Service; Border Grizzly Projects; Interagency Grizzly Bear Team; Idaho, Wyoming, and Montana Fish and Game Departments; U.S. Fish and Wildlife Service; University of Montana

Objectives:

1. Attempt to determine if competition for succulent vegetation between bears and sheep on the study area is a significant conflict.
2. Collect information on grizzly and black bear utilization of the study area in relation to habitat, range, seasonal movements, and livestock use.
3. Document any observed interactions between black and grizzly bears.
4. Document observed bear predation and compile available predation information from Forest Service and Fish and Wildlife Service files and other sources.
5. Examine and determine what management practices could reduce bear-livestock interactions and conflicts.

Results:

The student investigator completed her thesis. The summary follows.

1. Eleven black bears and two grizzlies were captured in the Targhee National Forest, Idaho-Wyoming, during 1976 and 1977. Seven black bears, collared with telemetric transmitters, were monitored to determine habitat use and interspecific/intraspecific relationships among and between bears and domestic sheep. Movements of the two radio-collared grizzlies using the study area were provided by the Interagency Grizzly Bear Study Team for inclusion in the bear/sheep interaction aspect of this study.

2. Sixty-five percent of the black bears captured were males, and nine black bears were subadults (2.5 to 3.5 years old). Annual summer home ranges of seven monitored black bears ranged from 0.9 km^2 (0.4 mi^2) to 22.2 km^2 (8.6 mi^2) by the minimum area home range method (Harvey and Barbour 1965).

3. Considerable home-range overlap existed among bears utilizing the same habitat. Both monitored female black bears utilized home range concurrently with one or more monitored males. Temporal mutual avoidance was observed.

4. The relationship between monitored black bears and grizzlies was similar to the intrarelationship among black bears. Mutual temporal avoidance was suggested (although not directly observed). Black and grizzly bears were observed within 0.75 km of each other with no apparent response.

5. Bears were most often observed in Douglas-fir/snowberry, Douglas-fir/globe huckleberry, and subalpine fir/globe huckleberry types.

6. Black and grizzly bears showed a significant difference in habitat utilization ($X^2 = 121.9$, $p < .001$, 2 DF) in similar habitats, suggesting grizzly preference of nonforested or semi-forested habitat types.

7. Analyses of 238 scats collected from the study area showed that grass and grasslike plants were the foods utilized most often; common horsetail, dandelion, lomatium, salsify, and clover were the succulent vegetation species most often encountered in the scats; 71% of the scats containing grass and succulent vegetation were deposited prior to mid-July. Huckleberries, hawthorn fruit, and serviceberries were the most common fruits and were used in autumn. Ants were present in 25% of the scats with the greatest occurrence in June-July. Sheep and undetermined meat appeared in 8.5% of the scats, and meat was present in 12% of the total number of scats.

8. The analysis of the stomachs of seven bears killed as the result of alleged depredations showed that four contained more than 40% sheep and two contained no meat or sheep. Vegetation, berries, and ants were also present in most stomachs.

9. Sheep use of habitat was observed. Tightly herded sheep herds experienced lower predation losses but caused greater range damage than herds allowed to graze in loose groups. Herding technique was probably the greatest factor

in reducing sheep mortality to all causes.

10. Vegetation found on the study area that was used by bears and sheep was tabulated. A bear food importance value, a sheep utilization rating, and a competition index were assigned to plants found in scats that were important to both bears and sheep.

11. Bear predation was discussed in detail. Sheep losses on the Targhee National Forest were compared to sheep losses reported in other studies. Bear mortality on the study area was compared to reported sheep losses during the same period.

12. Determination of the guilt or innocence of a bear suspected of depredations was difficult. In at least one case, a bear (monitored) was erroneously killed for depredations. The extent of unjustified bear removal is probably greater than commonly thought, although documentation would be difficult.

13. U.S. Fish and Wildlife Service records provided the most reliable information on bears killed as the result of alleged depredations. Bears killed by herders normally go unreported on U.S. Forest Service allotments. Herders and permittees cooperated in providing me with the normally unreported bear mortality. In 1976, 10 of the 17 bears (59%) killed on the study area were killed by sheepmen. Assuming that twice as many bears were killed in alleged depredations as were reflected in U.S. Fish and Wildlife Service reports, a minimum estimated black bear mortality for Dog and Grizzly creeks, Squirrel Meadows, South Boone, and Middle Boone allotments for 1970-1977 would be 62 bears.

14. The movements of monitored bears were plotted against the movements of sheep herds in their home ranges. Bears exhibited a variety of responses. Two bears showed interest in, two exhibited aversion to, and two demonstrated neutrality toward sheep herds and/or related activities in their home ranges.

15. Only one monitored black bear was verified as a sheep killer. His movements suggest his 1977 predatory behavior may have developed from scavenging and close

contact with larger bears who were involved in depredations during 1976.

16. My data indicate that the presence of sheep did not influence any collared bear to leave its established home range either to follow or avoid the sheep and/or related activities.

The Food Habits of and Habitat Selection by a Barren Ground Grizzly Female and Cubs, Brooks Range, Alaska

Project Leader:	B. W. O'Gara
Student Investigator:	J. Hechtel
Cooperators:	Alaska Department of Fish and Game, Naval Arctic Research Laboratory, National Wildlife Federation, Wildlife Management Institute, National Audubon Society, Theodore Roosevelt Memorial Fund of the American Museum, Arctic Institute of North America

Objectives:

1. To examine in detail the seasonal food habits of a female grizzly and her two offspring, and to provide a general account of bear food habits on the western North Slope.
2. To determine daily movement and activity patterns, seasonal movements and the home range of the bears.
3. To describe and map portions of habitat within the home range of the family group.
4. To determine the seasonal habitat use patterns of the bears.
5. To conduct qualitative analysis of important bear food items.

Results:

The student investigator is in the field. He will return from Alaska during autumn and plans to complete his thesis by June 1980.

A Survey of the Nongame Mammals in the Upper Rattlesnake Drainage of Western Montana

Project Leader:	B. W. O'Gara
Student Investigator:	E. B. Adelman
Cooperators:	U.S. Forest Service; Montana Fish and Game Department; Montana Power Company; Friends of the Rattlesnake; McInntire Stennis

Objectives:

1. To determine what species of nongame mammals inhabit the Drainage, their distribution by habitat, and relative abundance within each habitat.
2. To determine in a general way, the nature of the prey base and how it is utilized within each habitat type.
3. To make suggestions regarding the impact(s) various management options could have on the nongame mammals in the Drainage.

Results:

The student investigator has turned in the first draft of her thesis. The summary should appear in the next Biannual Report.

A Survey of Ungulates in the Rattlesnake Creek Drainage

Project Leader:	B. W. O'Gara
Student Investigator:	P. McBride
Cooperators:	U.S. Forest Service; Montana Fish and Game Department; Montana Power Company; Friends of the Rattlesnake

Objectives:

To determine the relative numbers, habitat relationships, and seasonal distributions of ungulates in the Rattlesnake Creek Drainage.

Results:

The student investigator is finishing the first draft of her thesis. The summary should appear in the next Biannual Report.

Pronghorn Fawn Mortality on the National Bison Range Following Selective Control of Coyotes During Spring

Project Leader:	B. W. O'Gara
Student Investigator:	P. Corneli
Cooperators:	Denver Wildlife Research Center, National Rifle Association, National Bison Range

Objectives:

1. To examine the causes and degree of pronghorn fawn mortality on the National Bison Range following selective control of coyotes;
2. to determine the density of coyotes;
3. to determine the relative densities of alternative coyote prey; and
4. to compare findings with data from previous studies without coyote control.

Results:

The student investigator turned in the first draft of her thesis. A summary should appear in the next Biannual Report.

Winter Habitat Selection and Movement of Elk (Cervus elaphus) in the Drainage of the Middle Fork of the Flathead River, Montana

Project Leader:	B. W. O'Gara
Student Investigator:	M. McDonald
Cooperators:	Montana Fish and Game Department, Flathead National Forest

Objectives:

1. To describe and determine winter habitat type and use.
2. To determine seasonal migratory routes via monitoring of radioed and collared elk.

Results:

The student investigator is writing his thesis. The summary should appear in the next Biannual Report.

A Study of Bighorn Sheep on Upper Rock Creek, Granite County, Montana

Project Leader:	B. W. O'Gara
Student Investigator:	T. Butts
Cooperators:	Bureau of Land Management; Montana Fish and Game Department

Objectives:

1. To determine herd size and composition and ewe/lamb ratios; and
2. to identify specific ewe/lamb habitat areas and movement paths and patterns.

Results:

The student investigator is working for BLM and analyzing data. The thesis should be completed during summer 1979.

White-tailed Deer Movements, Survival, and Population Characteristics in the Clearwater River Drainage, Montana

Project Leader:	B. W. O'Gara
Student Investigator:	B. Slott
Cooperator:	Montana Fish and Game Department

Objectives:

To further determine and describe:

1. summer distribution of white-tailed deer which winter in the Salmon Lake Area of the Clearwater Drainage;
2. production and survival, and conversely, mortality factors affecting this deer population;
3. population status--numbers and trend;
4. food habits; and
5. range conditions.

Results:

Winter studies involved determining population characteristics, food habits, movements, and mortality. Study during other months was directed at finding summer locations of these deer, analyzing browse transects, and habitat-typing the deer's summer ranges.

Between 350 and 550 deer use the 7.4 square mile winter range. Fawn:adult ratios for 1978 and 1979 were 48:100 and 55:100, respectively, indicating good fawn survival. The adult:female for 1979 was 23:100 and hunter harvest was the greatest mortality factor.

Throughout the area of high deer concentration, the browse were severely over-utilized and fallen conifers were stripped of their needles within 48 hours.

A large portion of the summer range was habitat typed, beginning with the home ranges of 6 radio-collared deer. These deer migrated an average of 9.8 miles from the winter range.

A Study of the Causes for Poor Pronghorn Fawn Survival on the Charles Sheldon Antelope Refuge, Nevada

Project Leader: B. W. O'Gara
Student Investigator: M. McNay
Cooperators: U.S. Fish and Wildlife Service, Nevada Department of Fish and Game

Objectives:

1. To examine the causes and degree of pronghorn fawn mortality.
2. To evaluate the condition of newborn fawns as an indicator of their dam's nutritional status, and thus, indirectly, the adequacy of the range for pronghorns.
3. To evaluate the adequacy of fawn bedding sites and the impact cattle have on those sites.

Results:

Twenty-one fawns were collared between 14 and 28 May. One was under observation when killed by a coyote. As of 22 June 1979, they were in the following categories:

Mortality--	7 coyote involved 1 eagle 1 abandonment 1 accidental (fell from cliff)
	10 Total mortality
Survival--	10 - all collars still on
Transmitter failure--	1 - last signal received 17 May

Vegetation analysis of 55 bedding sites included measuring canopy coverage and height of all plant species within each plot. Range transects were run in mid-May, early June, and mid-June to determine forage availability in areas where cattle grazing and pronghorn use overlap. Fecal samples collected in conjunction with those transects will be analyzed to determine dietary competition between cattle and pronghorns.

Thirty coyote scats were collected during the fawning period to gain information on the diet of this predator.

Body measurements, throat and anal swabs for bacterial culture, and blood samples were taken from collared fawns.

Field work will be completed in September 1979.

Elk Habitat Selection and Use, Movements, and Home Range on a Disturbed Summer Range in Western Montana

Project Leader:	C. L. Marcum
Student Investigator:	J. Lehmkuhl
Cooperators:	Bureau of Land Management, Montana Forest and Conservation Experiment Station

Objectives:

1. Describe environment available to elk.
2. Describe elk habitat selection and use, movements and home range on a forested summer range subject to concurrent logging.
3. Compare data with information obtained in the "predisturbance" phase of the long-term study.

Results:

The student investigator has completed 1 year of field and course work. His thesis should be available by autumn 1980.

A Study of an Introduced Mountain Sheep Herd in the Petty Creek Drainage, Montana

Project Leader:	J. Harris
Student Investigator:	L. Kopec
Cooperators:	Montana Fish and Game Department, Lolo National Forest

Objectives:

The primary objectives of this study are to:

1. locate and map seasonal ranges and movements;
2. census the herd; and
3. study lamb mortality.

Secondary objectives are to:

4. locate and map potential sheep range in the Petty Creek area; and
5. evaluate range conditions.

Results:

The Petty Creek herd consists of approximately 30 to 35 sheep with a sex ratio of about 70:100. Despite heavy snows and a hard winter, only 1 sheep, a $14\frac{1}{2}$-year-old ewe, was known to have died of natural causes. One ewe and 2 rams were killed illegally, and 1 ewe died during capture operations. Thus, the overwinter mortality was at least 15%. A total of 24 sheep were located in the spring. About half of the ewes and yearlings wintered in the French Gulch area, and half in the Petty Creek Canyon. Rams wintered singly or in small groups in the Petty Creek Canyon and in the Tucker Gulch area.

Lambing occurred in the Petty Creek Canyon in late May. Seven lambs were seen on 1 June, and no mortality has yet been noted. For this year, it appears that production may be about equal to or slightly less than the overwinter mortality.

Efforts during summer and fall will be directed toward capturing sheep for radio-collaring and marking.

Numerical Response of Woodpeckers and Their Effect on the Mortality of Mountain Pine Beetles in Lodgepole Pine in Northwestern Montana

Project Leaders:	B. R. McClelland, H. Lowe
Student Investigator:	A. Lester

Cooperators:	McInntire Stennis, University of Montana School of Forestry; National Park Service, Glacier National Park

Objectives:

1. To determine the feeding densities of woodpeckers in areas of epidemic and endemic populations of the mountain pine beetle (Dendroctonus ponderosae);
2. to determine the numbers of nesting pairs of woodpeckers in areas of epidemic and endemic populations of the mountain pine beetle;
3. to assess the woodpecker-caused mortality of mountain pine beetles on the study sites;
4. to characterize active woodpecker nest trees within the study area and relate the findings to forest management practices; and
5. as time permits, to determine the densities of other birds feeding on the mountain pine beetle in the study area.

Results:

The student investigator is spending her second field season in the study area. The study should be completed and the thesis completed by spring 1980.

Food Habits, Health, Population Dynamics, and Hunter Impact on the Middle Fork Elk Herd, Flathead Drainage, Montana

Project Leader:	B. W. O'Gara
Student Investigator:	Dennis Daneke
Cooperators:	Montana Fish and Game Department and the Flathead National Forest

Objectives:

1. To determine the seasonal food habits and report the abundance and importance of each item;
2. to determine the quality of key winter browse species;
3. to determine the herd's age structure;
4. to determine calf production levels; and
5. to determine the effect of hunting on population characteristics.

Results:

The student investigator has spent 1 year in the field locating mineral licks, feeding sites, counting and classifying elk bands,

operating hunter check stations, locating winter-killed elk, examining viscera piles and carcasses, collecting pellets for fecal analysis, and analyzing key browse species by the in-vitro digestion method. Data collection is complete for the digestion trials and mineral lick analysis. Field work is continuing on all other aspects and will be completed by December 1979.

The Effects of Human Disturbance on Great Blue Heron Colonies in Northwestern Montana

Investigator:	B. R. McClelland
Student Investigator:	J. Parker
Cooperators:	The Confederated Salish and Kootenai Tribes, National Wildlife Federation, Sigma Xi

Objectives:

1. to assess the impact of human activities on the reproductive success of Great Blue Herons;
2. to conclude the 1969-1970 field work of Dennis Billings, by summarizing his data on food habits and pesticides, and by comparing the locations of northwestern Montana heronries and their breeding successes in 1969-70 with those of 1978-79; and
3. to determine the necessary components of Great Blue Heron habitat in northwestern Montana, and to provide guidelines for management of this habitat.

Results:

Twenty-one active and inactive heronries on 4 major rivers have been located. Each active colony is being visited twice a month during the spring and summer of 1979, to determine the percentage of nests occupied and fledging rates. Additional observations are being made on colonial behavior and on differences in phenology between colonies. Measurements involved in habitat typing and colony dimensions (e.g., dbh's and heights of nest trees, nest heights, distance from water, distances from human activity, etc.) were made in the early fall and late winter of 1978-79.

The thesis should be completed by March 1980.

Habitat Selection, Populations, and Control of Black-Tailed Prairie Dogs (*Cynomys ludovicianus*) on the Charles M. Russell National Wildlife Range

Project Leader:	B. W. O'Gara
Student Investigator:	C. Knowles
Cooperator:	U.S. Fish and Wildlife Service, Charles M. Russell National Wildlife Range

Objectives:

1. determine distribution, size and status of all prairie dog towns within the Wildlife Range;
2. determine habitat selection by prairie dogs within the Wildlife Range;
3. determine population dynamics of prairie dogs and identify environmental factors which may influence numbers of prairie dogs within and between years within a prairie dog town;
4. investigate the dynamics of colonization by prairie dogs of the Wildlife Range;
5. evaluate and compare the effectiveness of three possible methods of control--poisoning, shooting and habitat alteration; and
6. investigate the association and relationship of prairie dogs to areas of intensive livestock use and/or areas of human disturbance.

Results:

The 1979 field season was begun on 1 April. Ninety prairie dogs, 57 females, were collected during April to obtain reproductive information; 68% of the females were lactating or pregnant. The average litter size was 5.

Examination of a 0.5 ha prairie dog town where Refuge personnel observed a badger on several occasions in December 1978 revealed that 20 of 29 burrows had been dug out by a badger. No live prairie dogs were observed and no active burrows were found.

Prairie dogs were livetrapped and marked during May in a portion of a dog town where similar work was done in 1978. Numbers in this area were down 34% from last summer. Survival rates were 81, 50, and 50% for adult females, adult males, and juveniles of both sexes, respectively. Despite the

loss, this portion of the dog town expanded into previously unused areas. The maximum count method for estimating relative trends in prairie dog numbers showed a 48% decrease from the previous summer and the burrow plug method showed only a 7% decrease.

Observations of 21 dispersing prairie dogs were made between 14 May and 14 June. Six of these were collected. No trends in age, sex, or reproductive condition could be established. These dispersing prairie dogs were found at distances of up to 5.6 km from the nearest dog town.

Prairie dog towns that received specific poison treatments in 1978 showed 2 trends. In towns where only portions were treated, numbers appear to be up in the treated areas and down in the adjacent nontreated areas from post-treatment surveys of last summer. In towns that were wholely treated, numbers of prairie dogs are essentially the same as post-treatment 1978.

Relative numbers of prairie dogs in the 2 towns that received the shooting treatment last year were down an average of 49% from the 1978 pretreatment adult population.

Inventory and Analysis of the Range and Wildlife Resources, Wildhorse Island, Flathead Lake, Montana

Investigator:	L. Eddelman
Student Investigator:	D. Kautz
Cooperators:	Montana Fish and Game Department, Nature Conservancy

Objectives:

To provide baseline data on the Island range and wildlife resources in order to evaluate, classify, and manage such resources relative to present and future goals and objectives. The inventory shall be aimed at total Island ecology rather than emphasizing specific factors pertaining to particular wildlife species.

Results:

The student investigator is in the field for the second season. His thesis should be completed in spring 1980.

University of Montana Grizzly Bear Research Investigations

Investigator:	J. J. Craighead
Co-Investigator:	J. S. Sumner and J. Varney
Student Assistants:	J. Mitchell and G. Scaggs
Cooperators:	U.S. Forest Service; Montana, Idaho, Wyoming and Alaska Departments of Fish and Game; National Rifle Association; National Geographic Society; Environmental Research Institute; University of Montana Foundation; Idaho Cooperative Wildlife Research Unit

Objectives:

1. To complete for publication with F. C. Craighead, Jr., a 15-year study of grizzly bears in the Yellowstone ecosystem and to encourage management agencies to utilize the research findings.
2. To develop a rapid, accurate, low-cost method of typing, mapping, and evaluating grizzly bear habitat utilizing LANDSAT imagery and computer-assisted analysis.
3. To continue studies of grizzly bears in the Lincoln-Scapegoat Wilderness Area in order to:
   a. determine relative bear numbers and relate this information to habitat use;
   b. quantify the amount, quality, distribution and seasonal fluctuations of three major plant foods used by grizzly bears.
4. To continue investigations of historic and present occupancy of the Selway-Bitterroot Wilderness by grizzlies and by using satellite-computer-assisted technology determine the quality of the present habitat for possible re-introduction.

Results:

Craighead delivered a report, "A Delineation of Critical Grizzly Bear Habitat in the Yellowstone Region," at the Bear Conference in Kalispell, Montana. The summaries of the sections on Bear/Man Competition and Delineating Critical Habitat follow.

Although the grizzly bear is essentially a wilderness species it can and does adapt to the presence of man, but it cannot and has not adapted to man's intensive use and modification of its habitat. Man must adapt to the grizzly and this will require a tolerance that we have not yet attained. Until we have educated

ourselves and our resource agencies to coexist with the grizzly in areas of competitive use, we must view competitive land uses within critical habitat delineations as potentially detrimental to the species.

Man is competing directly with grizzly bears for habitat in the Yellowstone region both inside and outside the Park. To perpetuate the species and to expand the population where possible, as directed by the Endangered Species Act of 1973, federal and state agencies will have to develop guidelines and management programs to alleviate direct competition between bear and man for the same geographic space and habitat.

I have delineated a specific land area in the Yellowstone region as critical habitat based on bear mortality records and the biological, physical and behavioral requirements of the species. The land area consists of Yellowstone National Park and portions of five adjoining National Forests. It encompasses an area of approximately 5,000,000 acres with minor exclusions for towns, campgrounds and developed areas. The area is considered as an ecosystem for the grizzly bear and supports a wide range of forest and grass-shrub habitat types some of which have been described and quantified. Vegetation zones range from temperate forests and grasslands at 5,000 feet to alpine tundra at 10,000 and above.

A boundary for the critical habitat area has been defined, with the recognition that refinements will be necessary to include easily observable landmarks and landforms in the boundary description. Refinements will also be necessary to make adjustments for private holdings, developed areas, intensive land use economies and for new sources of information in the future.

The area delineated by the U.S. Forest Service as occupied habitat is quite comparable to the area I have delineated as critical habitat based on criteria set forth in the Endangered Species Act. Thus the Forest Service's delineation of occupied habitat is, by my evaluation, actually critical habitat. On the other hand, the area defined as critical by the U.S. Forest Service is considerably smaller and partitioned, probably because it is not based on long-term biological studies or a holistic concept of the biological needs of the grizzly bear.

The U.S. Fish and Wildlife Service delineated an area nearly similar to the Forest Service occupied habitat. There has been considerable public criticism of this

delineation of critical habitat by state Fish and Game agencies, special interest groups, and by some bear biologists; but the federal delineation, with the exception of an area east of the Jackson Hole Valley, Wyoming, rather closely matches the area I have delineated from long-term data.

The critical habitat delineation I have proposed should be refined in the future by federal and state agencies as new information becomes available.

Where grizzly and man are competing for the same habitat, man-caused bear deaths rise. The bear has a low reproductive rate (approximately 1 cub per adult female every two years). This birthrate cannot offset heavy and persistant man-caused mortality. Where habitat is shared by bear and man, precautions must be taken to keep man-caused mortalities to a minimum. Such mortalities appear to be a greater threat to the grizzly in the Yellowstone ecosystem than direct modification of the habitat.

Delineation of a specifically-bounded ecosystem for grizzly bears in the Yellowstone region indicates that it will be feasible in the future to delineate precisely other ecosystems critical to the survival of the grizzly bear within the contiguous 48 states. This can be accomplished by recognizing the basic biological and ecological requirements of the bear in each ecosystem and the competing socio-economic needs of society. Where bear and man compete for the same space and habitat, conflicts can be resolved by improved land use management and improved people-bear management that will protect the grizzly and its environment yet also duly consider and protect other users and uses of the land. Grizzly and man can coexist. We must guard against unreasonable demands and undocumented assertions by concerned groups as well as untenable positions based on alleged jurisdictional authority. These can defeat objective habitat delineation of ecosystems essential to the preservation of the grizzly and prevent peaceful coexistence.

A suggested alternative is to remove the grizzly bear from endangered status. This has been advocated by a few bear biologists, game administrators and some special interest groups. Such action at this time would be highly questionable if not irresponsible in view of the recognized habitat conflicts and the demonstrated high man-caused mortality rates for the species. The recovery potential of a grizzly bear population is

low because of the species' low reproductive rate, the vulnerability of the bear to man and the lack of known biological compensating mechanisms to offset these factors. Grizzly bear populations don't readily make a comback as the history of the species shows. They require large wilderness-type environments and these large geographic areas must be delineated and managed as ecosystems of critical habitat. This can be done, to perpetuate the species as directed by the Endangered Species Act, without seriously infringing on the socio-economic uses of the ecosystem.

River Preservation

Project Leaders:	J. J. Craighead and F. C. Craighead, Jr.
Assistant:	B. W. O'Gara
Cooperators:	University of Montana Foundation, Environmental Research Institute, U.S. Forest Service, and the National Geographic Society

Objectives:

1. To produce an educational lecture film on river preservation.
2. To assist federal, state, and private organizations to evaluate and classify rivers for inclusion in the National Wild and Scenic River System.
3. To promote the National Wild and Scenic River concept through publications and illustrated lectures.
4. To encourage student involvement in environmental issues related to river preservation and management.

Results:

John Craighead worked with the Nature Conservancy this spring on acquiring access areas on the Smith and Blackfoot rivers.

Border Grizzly Project

Project Leader:	C. Jonkel
Assistant Researchers:	C. Servheen, Joe Perry, Tim Thier, Nanka McMurray, Harry Carriles, Lyndon Lee, Mark Haroldson, Rick Mace, and Dan Carney

Cooperators: U.S. Forest Service, Montana Fish and Game Department, U.S. Fish and Wildlife Service, U.S. Bureau of Land Management, University of Montana, New York Zoological Society, U.S. National Park Service, Bureau of Indian Affairs, British Columbia Wildlife Branch, Parks Canada, Canadian Wildlife Service, Idaho and Washington Fish and Game Departments, and the Alberta Fish and Wildlife Branch

Objectives:

1. To determine the population status and trends of the grizzly bear populations in northwestern Montana and eventually those in the contiguous areas of northern Idaho, extreme eastern Washington, and the border areas of Alberta and southeastern British Columbia in cooperation with the Border Grizzly committees.
2. To extrapolate biological information from other areas and other bear species to the Border Grizzly populations and to collect whatever additional biological data are necessary to describe the biological status and needs of the Border Grizzly populations.
3. To conduct comparative behavioral and physiological studies of penned and wild black, grizzly, and polar bears, and to relate these findings to other biological data, and to the use of possible deterrents to bear attacks on man.
4. To make qualitative and quantitative evaluations of habitat components (including habitat needs, changes in land use, reintroduction, hunting effects, etc.) which relate to the status of grizzly bears and to the carrying capacity of grizzly ranges in terms of the above, food abundance and productivity, habitat types, and denning sites.
5. To encourage the cooperation of management agencies to obtain and utilize research data in preparing drafts of detailed management techniques and procedures and to assist management through cooperative effort, draft plans, field demonstrations, etc., in the use and implementation of such procedures and techniques.

Results:

Bears with transmitters were monitored throughout the winter and during emergence from dens. Trapping programs were initiated during May in the North and South forks of the Flathead River, the Mission Front area, and along the East Front. Spring trapping resulted in the capture and release of 14 grizzlies, including 2 recaptures. Bears marked earlier and during spring were monitored by both ground and aerial tracking programs.

Much of the winter was spent completing BGP Special Reports on aspects of grizzly biology and ecology, preparing abstracts of papers for the 1980 Bear Biology Association conference, and working on annual reports. Two master's theses were reviewed extensively to meet Project and University deadlines.

Food habits analyses and plant specimen mounts were completed for presentation to agencies and the documentation of reports.

The Influence of Wildfire and Logging on Grizzly Bear Habitat

Project Leader: C. Jonkel
Student Investigator: P. Zager
Cooperators: U.S. Forest Service, Montana Fish and Game Department, U.S. Fish and Wildlife Service, National Park Service, University of Montana

Objectives:

To analyze the vegetation of grizzly bear intensive-use areas in general and seral areas caused by fire and/or logging in particular. From this information, assess the relationship between vegetation (bear foods particularly) on burned areas and logged areas.

Results:

Summer data were mapped, analyzed, and compiled in a report for the annual project report. Plant specimens were identified, relationships between fire/logging effects were evaluated, and plans for the summer, 1979, studies were finalized.

Mission Mountains-Swan Valley Grizzly Bear Study

Project Leader: C. Jonkel
Field Research Leader: C. Servheen
Field Assistant: D. Carney
Cooperators: Salish-Kootenai Tribal Council, Bureau of Indian Affairs, U.S. Forest Service, U.S. Fish and Wildlife Service, Montana Fish and Game Department, University of Montana

Objectives:

1. Determine the population level and status of the southern extent of the Border Grizzly Area bear population.
2. Determine the overall seasonal distribution and habitat use of the grizzly in the Mission Mountains, Swan Valley, and Lincoln area.
3. Determine the bear home ranges, movements, and habitat selection by use of radio-collared bears and direct field observations.

4. Determine the possibility of grizzly population recruitment into the Missions across the Swan Valley from the Swan Mountains and Bob Marshall area, and also determine if the Mission Mountains grizzly population is self-sustaining or if the Swan Valley is an essential route for recruitment to the area.

5. Determine the important areas of seasonal grizzly use in the Swan Valley and map the possible grizzly travel corridors between the Swan and Mission mountains.

6. In the Mission Mountain West Slope area:

   a. correlate land use, human activity, and habitat types with grizzly seasonal activity and use;

   b. determine home ranges and seasonal activity of radio-collared bears in the west slope area;

   c. assess the nature and origins of potential conflicts that arise between people and grizzlies on the west slope and develop valid management guidelines and procedures to aid tribal authorities in dealing with present and future grizzly use in the area; and

   d. survey the attitudes of local residents in regard to their close association with grizzlies and determine, with the help of these interviews, a history of grizzly occurrence in this area.

7. Determine the population status of grizzlies in the South Fork of the Jocko-Finley-Gold-Rattlesnake creek area and attempt to determine if this population is expanding into previously unoccupied habitat.

8. Monitor the home range movements of radio-collared bears in the Jocko-Finley-Gold-Rattlesnake creek area and note range changes that occur over a period of at least 3 years in order to assess range changes and habitat selection of grizzlies in this area and whether bears of this population may be expanding into previously unoccupied habitat.

Results:

An extensive report was prepared and presented to the BIA in draft form. Field work consisted of radio-tracking marked bears, conducting observations, and doing special vegetative studies. Considerable time was spent locating bear activity centers, mapping habitat components, and in liaison with BIA and tribal officials.

Black Bear Ecology and Management in the Northern Conifer-Hardwood Forests of Maine

Project Leaders: C. Jonkel and L. Pengelly

Student Investigator: R. Hugie

Cooperators: Maine Department of Inland Fisheries and Wildlife, University of Montana, University of Maine, National Rifle Association, Penobscot Valley Conservation Association, Border Grizzly Project

Objectives:

1. To determine black bear habitat and its use by bears in Maine.
    a. Describe available habitat in terms of cover types, topography, current use, and road networks.
    b. Describe bear distribution and movements in available habitat.
    c. Describe patterns of black bear behavior such as seasonal activity, sex and age similarities in movements, and how bears relate to human activity within their range.
2. To describe how black bear habitat can be perpetuated.
    a. Describe the effects of forest practices, fire, and other activities on bear habitat.
3. To describe the basic biological characteristics of black bears on the study area.

Results:

Final data from the calendar year 1978 field season were analyzed or were under study. Drafts of certain portions of the study were prepared, and the thesis outline has been completed. Other duties reduced emphasis on the thesis material during this report period.

Polar Bear Studies

Project Leaders: C. Jonkel and B. O'Gara

Faculty Cooperators: B. Pfeiffer, H. R. Fevold

Student Investigators: G. Miller, S. Martin, B. Cushing

Cooperators: University of Guelph; Manitoba Department of Mines, Resources, and Transportation Services; World Wildlife Fund (Canada); the Polar Continental Shelf Project; Canadian National Sportsmen's Shows; University of Oslo; Canadian Wildlife Service; Arctic Petroleum Operators Association; Norsk Polarinstitutt; University of Copenhagen; Quebec Wildlife Service; Northwest Territories Fish and Wildlife Service; Churchill Northern Studies Centre; and U.S. National Science Foundation

Objectives:

1. To develop techniques to monitor basic physiological responses to external stimuli and relate to behavioral responses; to develop studies of bear deterrent-attractant-aversive conditioning.

2. To study the various biological parameters of polar bears at select Polar Basin sites:

   a. denning areas
   b. migrations
   c. feeding areas
   e. food chains, currents, climatology, etc.

3. To study the ecology of various ice features deemed important to polar bears and develop a methodology for identification and mapping of such ice types.

4. Other studies as per the detailed, NSF research outline and subproject outlines.

Results:

Deterrent studies in the Churchill Bear Laboratory were completed and drafted (Miller). A series of possible bear repellents were tested on two male grizzly bears and two female polar bears. Each bear was implanted with radio-transmitters to monitor its heart rate, body temperature, and subcutaneous temperature in order to measure the bears' physiological response in addition to the observed behavioral response.

After the implantations and an appropriate recovery period, a series of basal observations were performed. The bears' activity, posture, and facial expressions were observed, while the physiological parameters were measured periodically. The stimuli used on each bear included recorded bear and people sounds, bells, horns, whistles, a Thunderflash, commercial dog repellents, a few household chemicals, and a "loom" stimulus that consisted of suddenly presenting the surface of a 3' x 5' piece of plywood to the charging bear.

The results indicate that though some recorded sounds induce caution in the animals, only the extremely loud and sharp sounds are consistently repellent (Thunderflash, boat horn, and Capchur gun). On the other hand, all of the chemicals sprayed in the bears' faces were effective repellents but with varying intensities. Though some of the stimuli were very effective, the duration of the responses was consistently short-lived (five minutes or less).

The attractant studies (Cushing) were slowed because funding became scarce. First indications are that certain people and manufactured items are indeed attractive to bears. A second field/lab season is planned for summer-autumn, 1979.

The ice ecology studies (Martin) were slowed considerably because of extremely unusual weather in the Arctic, 1978. Field plans were altered accordingly for 1979, and considerable data have been obtained through June 1979.

The East Greenland studies (Jonkel) were completed during April-May 1979 with the attachment of 4 satellite tracking collars to polar bears in cooperation with the Norsk Polarinstitutt and the University of Copenhagen.

S. Martin is completing the second season of field work on her M.S. thesis project, entitled Environmental Factors Affecting High Arctic Sea Ice Habitat of Polar Bears. Four successive field camps are being established between 19 May and 22 July. Two camps are placed in coastal areas known to be heavily utilized by polar bears (Ursus maritimus) and 2 are in lightly utilized areas.

Surveillance of adjacent sea ice allows observations of polar bears, seals, birds, and occasional other animals. The ice is photographed and mapped according to structural type. Plankton hauls are made.

Analysis of data will include comparison of these biological and physical factors between heavily and lightly utilized areas. The project will be completed by March 1980.

Seasonal Habitat Selection Movements and Home Range Size of Bobcats (Lynx rufus) in Northcentral Montana

Project Leader:	B. O'Gara
Student Investigator:	P. R. Knowles
Cooperators:	Charles M. Russell National Wildlife Refuge

Objectives:

1. to determine home range size and spatial arrangements of bobcats on the study area;
2. to determine seasonal habitat selection and movements of bobcats on the study area; and
3. to provide recommendations for management guidelines to the Charles M. Russell National Wildlife Refuge and the Montana Department of Fish and Game.

Results:

Field work was initiated in the latter part of January 1979. Trapping for bobcats began on 2 March 1979, and has been carried through to the present. A total of 819 trap nights by the end of May produced 2 captured bobcats and 2 escaped animals believed to have been bobcats. Other species captured in traps consist of 2 skunks (Mephitis mephitis) and 1 badger (Taxidea taxus).

The first bobcat was a 22-pound female captured in a live-trap and radio-tagged on 11 March. A 25-pound male was captured in a leghold trap and radio-tagged on 5 May. A total of 99 relocations on both cats has been made to date. Approximately 59% of the relocations (excluding den sites) have been made in a Douglas-fir/juniper habitat type, 26% in a ponderosa pine/juniper type, 7% in juniper thickets and 7% in a grass/low shrub habitat type. Home range size of the female is approximately 2 square miles and that of the male is approximately 20 square miles.

The female denned between 16 and 18 May and gave birth to 2 kittens. The den was located about 50 feet from the highway and hidden from the road by a slump. This was the first time the cat was ever relocated in a grass-type. The "den" consisted of a depression in the ground in dense grass. The kittens were moved by the female on 13 June 1979.

An Investigation of Elk-Cattle Relationships on Elk Winter Ranges of the Crazy Mountains, Montana

Project Leader:	J. T. Harris
Student Investigator:	M. Wunder
Cooperator:	U.S. Forest Service

Objectives:

1. to estimate the combined elk and cattle carrying capacity of the elk winter range;
2. determine how increasing elk numbers will affect cattle grazing on National Forest Lands;
3. develop an option oriented plan to suggest relative elk and cattle numbers, including possible management actions to achieve and maintain desired population levels; and
4. suggest locations for permanent indicator transects, plots and or exclosures to monitor winter range vegetation changes.

Results:

In June 1978, most of the known or suspected winter concentration areas associated with the Crazy Mountains of central Montana were surveyed for elk use. Of these, 17 were selected for intensive study, based on elk use, area, aspect and elevation. Then they were intensively sampled to determine pellet group distribution, vegetative condition, soil, and vegetation trend and forage utilization by cattle. Additionally, I mailed opinion surveys to all affected landowners in the area to determine how they feel about the elk herd. Limited field work relating to pellet group distributions, cattle food habits, and elk food habits on winter range areas will be conducted during the 1979 field season as funding permits.

Morphological Variations Within the Subspecies *Ursus arctos horribilis*

Project Leaders:	B. O'Gara and C. Jonkel
Student Investigator:	H. W. Sherwood
Cooperators:	Montana Department of Fish, Wildlife, and Parks, Bozeman Laboratory; J. J. Craighead

Objectives:

1. to develop new procedures for accurately measuring variations in cranial characteristics with regard to age and sexual dimorphism; and
2. to further clarify understanding of the systematics of the brown/grizzly bear complex in North America.

Results:

The student investigator is measuring and examining cranial characteristics.

Ecology of the Bobcat (*Lynx rufus*) in a Coniferous Forest Environment

Project Leader:	B. O'Gara
Student Investigator:	S. Albert
Cooperator:	Montana Department of Fish, Game, and Parks

Objectives:

1. describe overall status of western Montana bobcat populations and evaluate their structure and dynamics;

2. characterize habitat requirements, home range, and general movements;
3. delineate reproductive processes and relate them to the state of the overall population;
4. evaluate food preferences by stomach analyses and scats; and
5. suggest management options based on the results of this study which could improve management of bobcats.

Results:

The student investigator spent a major portion of available field time learning to track and operate a trapline in a temporary study area in Lolo Creek Drainage. Efforts to livetrap bobcats were limited by unseasonably cold weather and academic commitments. A thorough literature review was completed and proposals for private and agency funding were sent. A preliminary draft of a detailed hunter/trapper questionnaire regarding bobcats was developed. Several reproductive and gastrointestinal tracts were obtained from local trappers and preserved. A technique for aging bobcats by cementum annuli analysis was developed and appears to offer dependable results.

The student investigator expects to be in the field on a permanent basis throughout the coming winter.

Ecological Relationships of the Bobcat in Northwestern Nevada

Project Leader:	B. O'Gara
Student Investigator:	R. Flynn
Cooperators:	National Wildlife Federation, U.S. Fish and Wildlife Service, Nevada Department of Fish and Game

Objectives:

1. to investigate bobcat population parameters on the Sheldon National Wildlife Refuge, Nevada, including
   a. adult spatial relationships, movements, and sex/age structure,
   b. denning areas, kitten production, mortality, and dispersal, and
   c. abundance of bobcats in different habitats;
2. to describe bobcat food habits, including
   a. composition of prey species in diet,

   - b. age-specific food relationships, and
   - c. abundance of primary prey species in different habitats; and
3. to investigate interspecific relationships between bobcats and coyotes within mutually occupied habitats.

Results:

The student investigator spent winter and spring quarters in Malaysia conducting a field study of the Sumatran rhinoceros (Dicerorhinus sumatrensis) under contract for World Wildlife Fund International. Initial field work on this project will begin in August.

A Comparative Analysis of Ecological Relationships Between Woodpeckers and Insect Prey Species in Cut and Uncut Sections of the Pattee Canyon Burn

Investigator:	B. R. McClelland
Student Investigator:	M. Harris
Cooperator:	Lolo National Forest

Objectives:

1. to compare woodpecker population densities in the Pattee Canyon burn and adjacent unburned forest;
2. to identify species and distribution of insects fed upon by woodpeckers within the burn;
3. to characterize microhabitat preferences exhibited by insect prey species within the burn;
4. to characterize woodpecker nesting sites within and adjacent to the burn; and
5. to propose management guidelines for post-fire logging which would maintain suitable habitat for woodpeckers and associated cavity nesters.

Results:

The first season of field work is currently underway. Work will continue through the summer of 1980.

Riparian Habitats in Western Montana: Their Uniqueness to Nongame Birds and the Effects of Livestock Grazing on the Structure of Their Avian Communities

Project Leader:	R. L. Hutto
Student Investigator:	S. Mosconi

Cooperators: USDI Fish and Wildlife Service, Denver Wildlife Research Center

Objectives:

1. define the "value" or uniqueness of riparian habitats to nongame birds through seasonal comparisons of bird compositions and diversities in riparian and non-riparian habitats in western Montana; and
2. determine the effects of grazing on nongame bird communities and investigate the mechanisms behind any changes in bird species composition in grazed and ungrazed riparian plots.

Results:

The first field season began on 11 June 1979. Sites have been selected for 2 comparisons of grazed and ungrazed riparian habitats and bird censusing has begun. Certain vegetation parameters will also be measured. Censusing will continue in the migratory periods and winter. More specialized investigation will follow in the next field season.

Local and Long-Range Movements of Bald Eagles Associated with Autumn Concentrations in Glacier National Park

Project Leader: B. R. McClelland
Student Investigator: L. Young
Cooperators: USDA National Park Service, Glacier National Park

Objectives:

1. to determine migration routes, wintering areas, and nesting areas of Bald Eagles associated with autumn concentrations in Glacier National Park;
2. to determine daily movement patterns of Bald Eagles in and near Glacier National Park during autumn concentrations;
3. to gather morphological data (weight, measurements, plummage characteristics, etc.) on each captured Bald Eagle;
4. to monitor Bald Eagle numbers by conducting weekly censuses during autumn concentrations; and
5. to prepare a detailed report for use in a coordinated regional management plan for Bald Eagles.

Results:

McClelland initiated systematic censuses and observations in the study area during the years 1965 to 1970. McClelland and Shea conducted the censuses and observations during 1971, 1972, 1977, and 1978. Limited censusing was done by Park Rangers during 1973 through 1976. McClelland produced a progress report giving a complete description of Bald Eagle work through 1977.

Pronghorn Antelope Behavior in Northwestern Nevada

Project Leader:	B. W. O'Gara
Student Investigator:	J. O. Meeker
Cooperator:	U.S. Fish and Wildlife Service.

Objectives:

1. to examine the effects of playa availability on the breeding behavior of mature males;
2. to determine seasonal movements of pronghorn; and
3. to develop age composition of the subject resident herd.

Results:

Field work scheduled to begin 1 July 1979.

The Effects of 1080 Control of Columbian Ground Squirrels on Target and Non-target Mammal and Bird Populations

Project Leader:	B. W. O'Gara
Student Investigator:	J. C. Malloy
Cooperators:	Montana Departments of Agriculture, Livestock, and Fish and Game

Objectives:

1. to estimate changes in non-target bird and mammal populations subsequent to treatment on control and experimental areas;
2. to estimate changes in Columbian ground squirrel population levels subsequent to treatment on control and experimental areas; and
3. to estimate the toxicity of 1080 poisoned ground squirrel carcasses recovered in the field to selected mammalian and avian scavengers.

Results:

The student investigator spent winter quarter taking courses and began field work in the spring.

A Study of Social Organization, Social Behavior, and Population Dynamics in Rocky Mountain Bighorn Sheep on the National Bison Range, Moiese, Montana

Project Leader:	D. Jenni
Student Investigator:	J. Hogg
Cooperator:	The National Bison Range

Objectives:

1. to compile a quantitative catalog of the frequency of occurrence and the social context of selected behavioral acts, with special emphasis on behavior during rut and lambing;
2. to quantitatively characterize social organization using the following parameters: group size, group sex ratio, group age structure, dispersion of groups and individuals within groups, relative group movement;
3. to determine the number of ewes bred, the survivorship of lambs and the causes of mortality in lambs;
4. to initiate the construction of a current or cohort life table and to identify causes of mortality in yearlings and adults;
5. to determine numbers of animals in each year age class and to detect seasonal and between year changes in these numbers; and
6. to detect statistical relations between the behavioral and population data.

Results:

The student began observations in June and will be in the field through autumn.

An Assessment of the Ecological Impacts of the Libby Additional Units and Reregulating Dam (LAURD) Project and Libby Dam on the American Bald Eagle

Investigators:	J. J. Craighead and L. Craighead
Cooperators:	U.S. Army Corps of Engineers

Objectives:

To assess the impacts of LAURD on Bald Eagles.

Results:

The management recommendations follow:

Management suggestions to deal with the amelioration of altered or destroyed habitat can be considered in three ways:

1. Those to preserve or modify existing habitat during project construction, including use of artificial habitat.
2. Those identifying habitat needs after the project is completed when additional modification and use of artificial habitat will be required.
3. Those considering the project effects beyond the LAURD area--the entire geographical area.

1. Existing habitat can be preserved by:
   a. Leaving a belt of vegetation including trees 50 to 150 feet high between the full pool level (2130 feet) and any roads or railroads. This belt should be as wide as possible. If possible, the planned relocation of roads and railroads should be shifted farther away from the reregulating pool to leave such a green belt.
   b. Shoreline and island trees above river mile 217 should be stabilized by diking or other methods to prevent erosion. The resident engineer's proposal for preserving the island and waterfowl habitat near river mile 218 should be given serious consideration.
   c. Island trees between the Fisher River confluence and river mile 218 could be selectively thinned and the remaining trees anchored with rip-rap or concrete or properly guyed and injected with a systemic preservative. These trees will have their roots flooded and will eventually die, but if properly anchored and preserved should serve as valuable perch sites.
   d. Artificial perches can be placed in the reregulating pool area. Poles or dead trees 50 to 100 feet above water level will possibly be utilized if they can be placed in the water on high ground or at the edge of the pool as far away from highways as possible. Perches should be placed about 1 mile apart. Dead trees may be more aesthetically appealing than poles and may be more attractive to eagles than poles. Steenhof (1978) found that poles were not very successful as perch sites. Dead trees could be cut and moved and anchored in

cement, or live trees could be injected with a systemic preservative, cut and moved, and anchored in cement.

2. After the project is completed, a similar bald eagle study should be undertaken to identify further habitat needs caused by the project. For instance, the creation of waterfowl habitat such as pond areas or floating islands may be desirable.

3. Even if the food supply is unaffected, the destruction of shoreline habitat will reduce eagle use of the area. Such a change in a 10-mile segment of the river is probably tolerable by the migrating and wintering populations of bald eagles as long as the remaining habitat is unchanged. It must be considered, however, that similar changes in the remainder of the Kootenai River are planned; other dams and power line corridors are under consideration. The completion of several such projects will compound the impacts on the bald eagle. The reservoir, Lake Koocanusa, above Libby Dam is used by very few wintering eagles, and similar reservoirs will greatly reduce wintering habitat for the bald eagle. At some point a balance must be struck between necessary development and the preservation of critical habitat. Perhaps an overall review of hydro and other development projects planned for the Kootenai River and its drainages should first be undertaken by resource agencies to determine which is the most important and least environmentally degrading.

CONSERVATION, EDUCATION, AND PUBLIC RELATIONS

B. W. O'Gara

12 January	Met with local land developer, ranchers, and Wildlife Federation representative concerning donations and purchases of critical elk winter range near Missoula.
17 January	Met with personnel from the Montana Departments of Agriculture, Livestock, and Fish and Game in Helena concerning 1080 poisoning problems.
24 January	Met with two Russian scientists who were touring the United States to discuss wildlife management.
29 January	Met with a land developer and Wildlife Federation representative concerning management of local elk winter range.
30 January	Met with representatives of the Denver Wildlife Research Center and Montana Fish and Game to discuss a cooperative riparian habitat study.
31 January	Attended meeting of the Montana Chapter of TWS in Missoula.
1 February	Met with the manager of the National Bison Range and U of M Cooperative Education to evaluate minority applicants for the U. S. Fish and Wildlife Cooperative Education program on Montana Refuges.
2 February	Attended the Montana Chapter of TWS business meeting in Missoula. He presented, and got accepted amendments to the By-laws, and explained the current guidelines for environment action to the chapter members.
5 February	Participated in a meeting of the Montana Agriculture and Livestock Departments concerning 1080 poisoning of Columbian ground squirrels in western Montana. He was appointed about 2 years ago as Interior's Representative to a combined Agriculture-Livestock-Fish and Game Committee on 1080. He is now also chairman of the Montana Fish and Game Department's Oversight Committee on 1080 poisoning.

7-8 February	Participated in a Denver, Colorado, meeting to formulate management and research plans for the USF&WS concerning Golden Eagles; attended at the request of Nelson Swink.
9 February	Met with Regional Director, Harvey Willoughby, and spent 2 hours discussing problems related to transferring elk to states, other than Wyoming, from the National Elk Refuge. Advised Mr. Willoughby that the USF&WS might be liable to legal action by ranchers if brucellosis suddenly appeared in a "clean" area after introduction of elk.
12 February	Discussed, via telephone, the qualifications of a minority U of M student for the Cooperative Education Program with the Refuge Supervisor in the Area Office.
13-15 February	Attended annual meeting of the Northwest Section of TWS in Portland, Oregon. Took three graduate students to the meeting and gave a talk on "Let's Tell the Truth About Predation."
17-18 February	Spent weekend judging films for the U of M Wildlife Film Festival.
21 February	Presented a seminar to the U of M Zoology Department on "Coyote and Eagle Predation in Montana."
23 February	Met with the BIA and Tribal Biologists from the Confederated Kootenai and Salish Tribes Reservation to encourage them to recruit Indian students from the Reservation schools to the U of M Wildlife program.
1 March	Gave a $1\frac{1}{2}$-hour lecture to the School of Forestry Big Game class on "Management Guidelines for Pronghorns."
2 March	Appeared on KECI TV news to discuss a proposed game ranch in eastern Montana.
5 March	Lectured to the School of Forestry Park Management class on "Wildlife Management in African and Japanese Parks."

7 March	Participated in meeting of the Joint Montana Agriculture, Livestock, and Fish and Game departments Oversight Committee on 1080 Poisoning in Helena. Finalized study plan for documentation of hazards to non-target species during poisoning of Columbian ground squirrels.
8 March	Lectured for 3 hours in evening to Continuing Education class in Deer Lodge, Montana, on "Montana Big Game."
15, 16, 26, & 29 March	Met with Fish and Game Department personnel and developers to map and plan elk winter range, cluster housing developments, and conservation easements on Grant Creek Ranch.
29 March	Attended meeting of Missoula County Commissioners at request of the president of the County Rodent Control Board to answer questions regarding 1080.
30 March	Presented a slide program at Hawthorn School regarding Montana wildlife for National Wildlife Week.
Jan/Feb/March	Taught Mammalian Reproduction with Dr. Wright (14 graduate students), Technical Writing (11 graduates), and Wildlife Diseases and Parasites (14 graduates, 37 undergraduate students).
6 April	Spent entire day on Grant Creek Ranch with representatives of the Wildlife Federation and Friends of the Rattlesnake evaluating the potential impact of subdivisions on deer and elk.
9 April	Met with Grant Creek developer and Montana Fish and Game personnel concerning subdivisions on winter ranges for big game.
13 April	Lectured on "An Overview of Wildlife Resources and Problems in Montana" to a Forestry class on Conservation of Montana's Natural Resources.
19-20 April	Attended large animal restraint workshop sponsored by Federal Aid to Wildlife at CSU, Fort Collins, Colorado.

30 April	Moved a bull elk from the Bison Range to Missoula for a study. Took several graduate students and Bison Range personnel along to show them how to use a combination of drugs for immobilization followed by tranquilization and physical restraint for travel.
2 May	Collected and necropsied a pronghorn buck for the junior forestry class from Lubrecht Forest.
3 May	Met with regional personnel from the Montana Department of Fish, Wildlife, and Parks to acquaint them with the 1080 poisoning program for ground squirrels.
7 May	Met with a local rancher concerning game ranching.
10 & 15 May	Lectured to an interdisciplinary workshop on modeling big game ecosystems on predator-prey relationships in Montana, stressing annual and area-to-area variations.
11, 13, 29, and 30 May	Met with developers and Montana Fish, Wildlife, and Parks personnel for on site inspections and reviews of housing developments and winter elk ranges.
14 May	Lectured to a Forestry class from Yale on predation and predation control problems in Montana and Texas.
15 May	Gave a slide lecture to a Sentinel High School class on common diseases and parasites of Montana game with emphasis on what is dangerous to humans and dogs.
17 May	Spent all day at Savanak Ranger Station at the Superior and Saltese Outdoor School. Lectured on "How a Scientist Works," "Hunting as a Management Tool," "Predation Management," and "The Montana Unit Research Program." Also showed several movies.
18 May	Necropsied an elk for a senior wildlife management course.

31 May	Reviewed a 5-page manuscript for the Journal of Mammalogy and a 59-page proposal for the NSF.
April-May	Participated in a twice weekly modeling course conducted by the Mathematics and Zoology Departments.

D. A. Jenni

10-15 June	Attended the Animal Behavior Society meeting at Tulane University, New Orleans.

R. Flynn

17 January	Presented lecture on Wildlife Conservation in Malaysia to Wilderness Management class, U of M.
16-20 April	Attended the 5th International Symposium on Tropical Ecology at the University of Malaya, Kuala Lumpur.

A. Lester, S. Martin, and S. Albert

13-15 February	Attended Northwest Section of TWS meeting in Portland, Oregon.

T. Butts and L. Kopec

5 March	Attended Annual Pacific Northwest Bird and Mammal Society meeting in Missoula, Montana. Butts gave a presentation, "Distribution and Population Characteristics of the Upper Rock Creek Bighorn Sheep."

C. Jonkel

13 January	Presented talk on grizzlies to Idaho Chapter of the Wildlife Society, Boise.
16-17 January	Attended Federal-Provincial Polar Bear Technical Committee Meeting, Edmonton.
12 January	Participated in joint BGP-Yellowstone Study Team meeting, Bozeman.

30 January	Gave talk to Missoula Kiwanis regarding bears.
31 January-1 February	Attended IUCN Polar Bear Group meeting, Copenhagen.
13 February	Gave lecture in big game class, U of M.
20 February	Gave lecture in big game class, U of M.
22 February	Gave talk to public, U.C. Ballroom, U of M.
3 March	Gave paper at Pacific Northwest Bird and Mammal meeting, Helena.
7 March	Gave talk to Biology Club, Columbia Falls High School.
20-21 March	Gave address, attended sessions, Western Black Bear Workshop, Tempe, Arizona.
23 March	Gave presentation at Flathead grizzly hearing, Cranbook, B.C.
27-28 March	Headed Parks Canada hearing on Lake Louise grizzly problems, Calgary.
5 April	Gave talk to Elks' Club regarding grizzly studies.
15 May	Gave talk to Kiwanis Club, Missoula.
17 May	Gave lecture regarding international wildlife law.
12 June	Met with BLM personnel, Choteau.
20 June	Gave talk to Association for Conservation Information, Big Fork.
23 June	Gave talk to State Journalism Honorary, Kalispell.
30 June	Testified re grizzly and mammals in general, Rattlesnake Wilderness hearings, Missoula.

P. McBride

30 March	Gave a slide show and talk on wildlife to grades 3 through 5 of the Russell School and grades 4 through 5 of the Hawthorne School in conjunction with National Wildlife Week.

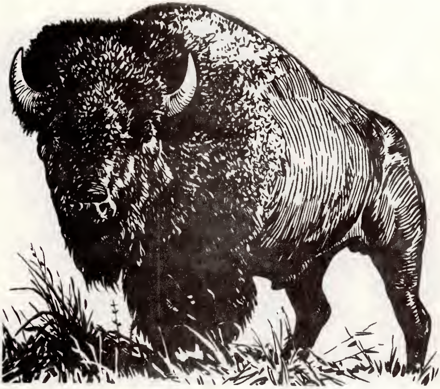
May	Took a field trip with the third graders of Prescott School to identify and discuss wildlife and wildlife habitats.

A. Lester

7-8 March	Attended Western Forest Insect Work Conference in Boise, ID. Gave presentation on woodpeckers and mountain pine beetles.

S. Martin

30 April	Gave a guest seminar at the Department of Fisheries and Wildlife, Oregon State University, Corvallis.



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